Changes in

BREEDING BIRD POPULATIONS

Between 1930 and 1985 in the Quaker Run Valley of Allegany State Park, New York

TIMOTHY H. BAIRD

The University of the State of New York
The State Education Department
Albany, New York 12230

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Salamanca, NY 14779

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Abstract

This study analyzes changes over a 50-year period in the breeding birds of the Quaker Run valley, Allegany State Park, western New York. In 1983, 1984, and 1985, I surveyed the breeding birds of this largely forested region of 16,990 acres (6877 hectares) using methods virtually identical to those used in 1930 and 1931 by Aretas A. Saunders. During the 50-year period, overall density of nesting birds declined from 84.6 to 73.1 pairs per 100 acres. Species composition changed as well, although the total number of species remained the same. Maturation of the forest and increased browsing of the understory by white-tailed deer are the two most significant changes in the terrestrial habitats of Quaker Run valley during the past 50 years. These habitat changes are related to at least some of the observed increases and decreases in local populations of individual species. The changes in local populations vary greatly from species to species, and often are not similar from habitat to habitat for a given species. The largest decline in this study is among forest species that generally build nests less than 2 meters above the ground. This decline may be related to the heavy browsing of white-tailed deer. Within the study area, major local declines over the past 50 years have occurred for the Chimney Swift, Hairy Woodpecker, Blue Jay, American Crow, Black-capped Chickadee, Swainson's Thrush, Hermit Thrush, American Robin, Cedar Waxwing, Chestnut-sided Warbler, Magnolia Warbler, Black-throated Blue Warbler, Black-throated Green Warbler, Black-and-white Warbler, Ovenbird, Canada Warbler, Indigo Bunting, Rufous-sided Towhee, Field Sparrow, Song Sparrow, and Vesper Sparrow. Major local increases over the past 50 years have occurred in the Yellow-bellied Sapsucker, Downy Woodpecker, Eastern Wood-Pewee, Acadian Flycatcher, Least Flycatcher, Veery, Wood Thrush, Red-eyed Vireo, Blackburnian Warbler, Cerulean Warbler, Mourning Warbler, Hooded Warbler, and Chipping Sparrow. Some of these local increases and declines do not agree with regional assessments from other sources. The overall picture of population changes in northeastern forest birds is very complex, and certainly many more long-term studies are needed. This study does not provide clear evidence that species which migrate to the neotropics are declining more rapidly than less migratory species.

Introduction

There is concern that the cutting and fragmentation of tropical forests will lead to environmental declines with global impact. One aspect of this concern is that populations of birds nesting in the United States, but migrating to and wintering in the tropics, are being adversely affected (Rappole *et al.*, 1983; Terborgh, 1980).

Evidence for such effects on birds must compare population changes over time. This study compares bird populations separated by more than 50 years at one of the few sites where population data exist from so long ago. During 1983, 1984, and 1985, I censused summer (breeding) bird populations in the Quaker Run valley of Allegany State Park, southern Cattaraugus County, western New York State (Figure 1). During the summers of 1930 and 1931, Aretas A. Saunders censused breeding birds at the same location (Saunders, 1936). A comparison of the data obtained during the two studies provides information on population changes at this locality.

Lying south of the course of the Allegheny River and north of the New York-Pennsylvania State line, Allegany State Park encompasses more than 60,000 acres (243 sq km), making it New York's largest State Park. The physiography of Allegany State Park is a dissected plateau (Allegheny Plateau, Tesmer, 1975) with a total relief of 1000 feet (305m). Flattened ridges characterize the upper elevations that rise to slightly over 2300 feet (701m) above mean sea level. Narrow stream valleys broaden slightly near their terminations at the Allegheny River. A detailed discussion of the physiographic character of Allegany State Park is provided by Lobeck (1927). The Park and its immediate vicinity escaped Pleistocene glaciations making this area the most northerly region of unglaciated landscapes in eastern North America (Tesmer, 1975). A mosaic of oak, cherry, Allegany hardwoods, and hemlock hardwood forest types covers more than 90 percent of Allegany State Park (Koten, 1981). The woodlands extend southward into Pennsylvania to merge with the extensive Allegheny National Forest.

In 1927, Allegany State Park became the setting for a formal program of nature study and instruction with the establishment of the Allegany School of Natural History along a stream called the Quaker Run in the southern section of the Park. Prior to 1927, Aretas A. Saunders spent several summers in the park, studying its wildlife. His studies of the area's natural history continued while he served as an instructor at the Allegany School of Natural History. Saunders' work resulted in several publications concerning the natural history of Allegany State Park (Saunders 1923, 1926, 1932, 1936, 1938, 1942).

From 1 July through 15 July of 1930 and 1931, Saunders collected data on breeding birds in the Quaker Run valley. Saunders restricted his data collection to the drainage area of the Quaker Run in the Park. He calculated the area to be approximately 26.5 square miles or 16,967 acres (6,867 ha.). The large area made Saunders' bird census an ambitious project. His field expertise and familiarity with the study area favored success. A formal training in forestry helped shape the methods Saunders used to obtain data.

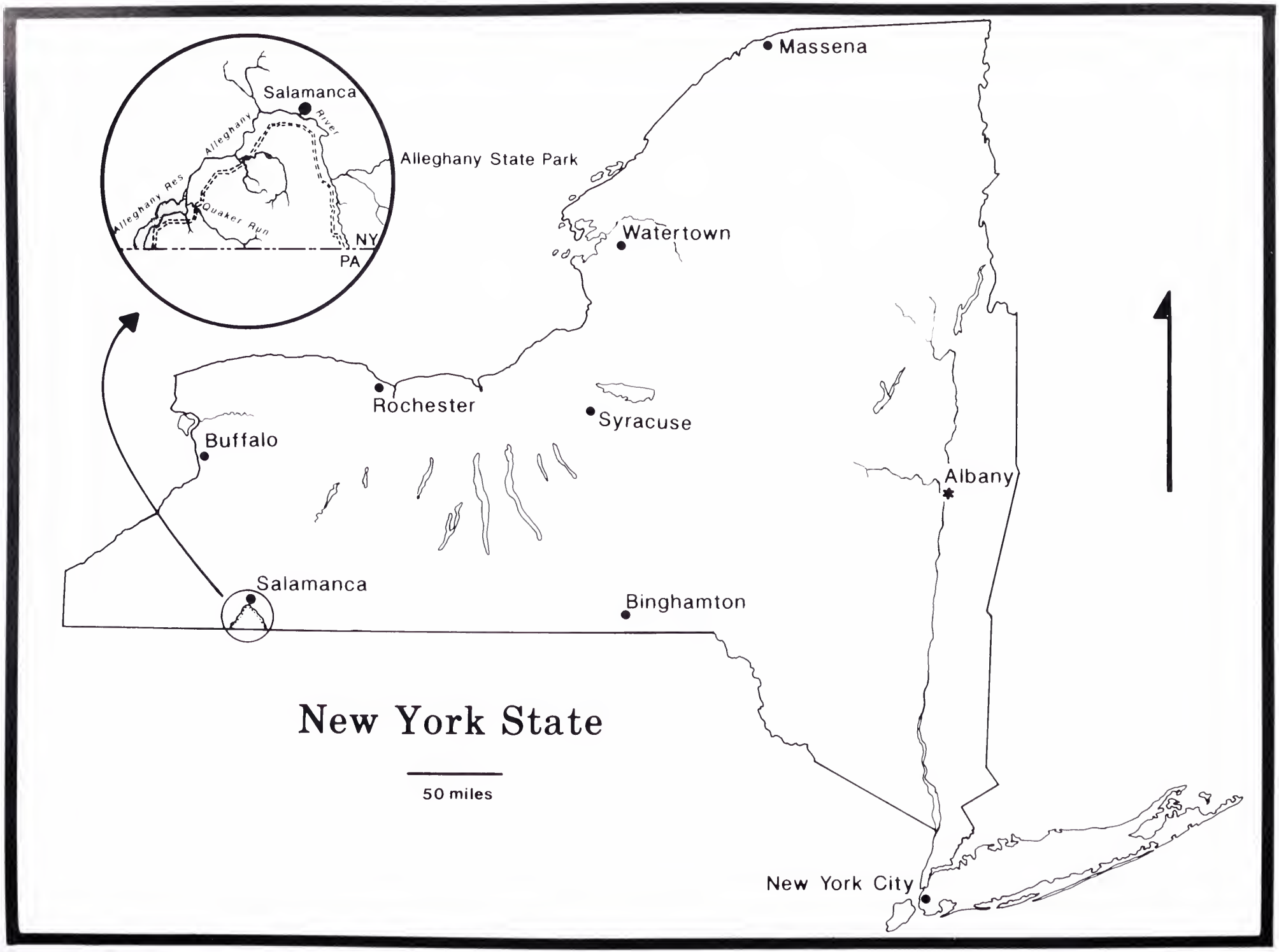
About 90 percent of the Quaker Run valley was forested in 1930-31 (Saunders, 1936; Figure 2 herein). Saunders worked in a forest that was generally in the early stages of recovery following extensive logging over many years (Taylor, 1928; Koten, 1981). Areas cleared of forest at that time were the result of farming activity in the lower valley of the Quaker Run where soil and terrain accommodated agriculture (Gordon *et. al.*, 1937). In 1983-85, a forest of similar extent, but of different character, occupied the study area (Table 1).

Since the establishment of Allegany State Park in 1921, there has been no formal management of its extensive forest, although proposals for management were made in its early years (Gordon *et al.* 1937). A management plan was proposed in 1981 (Koten, 1981) to address the recreation and wildlife needs in Allegany State Park. However, as of this writing, no plan for management has been instituted. The administration of Allegany State Park has been handicapped by the lack of a management plan from the State. The lack of forest management is partly responsible for a negative impact on vegetation and forest regeneration by white-tailed deer (*Odocoileus virginianus*) and beaver (*Castor canadensis*) (Koten, 1981). The activities of these animals and an extensive, even-aged, mature forest have altered the forested bird habitats in the Quaker Run study area to a significant degree since 1930-31.

Much of what was farmland in 1930-31 in the lower Quaker Run valley was inundated in the middle 1960s when the Quaker Run was dammed forming the 275 acre (111 ha) Quaker Lake (Koten, 1981). The small lake near the site of the Allegany School of Natural History, now known as Science Lake, was called "Quaker Lake" by Saunders.

The habitat requirements of birds is an important determinant in their nesting distribution. This relationship was a main concern of Saunders' study. The determination of the variety of habitats and their location within the large area comprising the Quaker Run valley required considerable time and effort by Saunders. A 1980 vegetative cover map prepared by Peterson and Associates (James Rich, pers. comm.) for the proposed Park management plan (Koten, 1981) mitigated similar efforts by the author.

TIMOTHY H. BAIRD


Massena
Salamanca
Allegheny River
Allegheny Res
Quaker Run
Alleghany State Park
NY
PA
Watertown
Rochester
Syracuse
Buffalo
Albany
Salamanca
Binghamton
New York City
New York State
50 miles

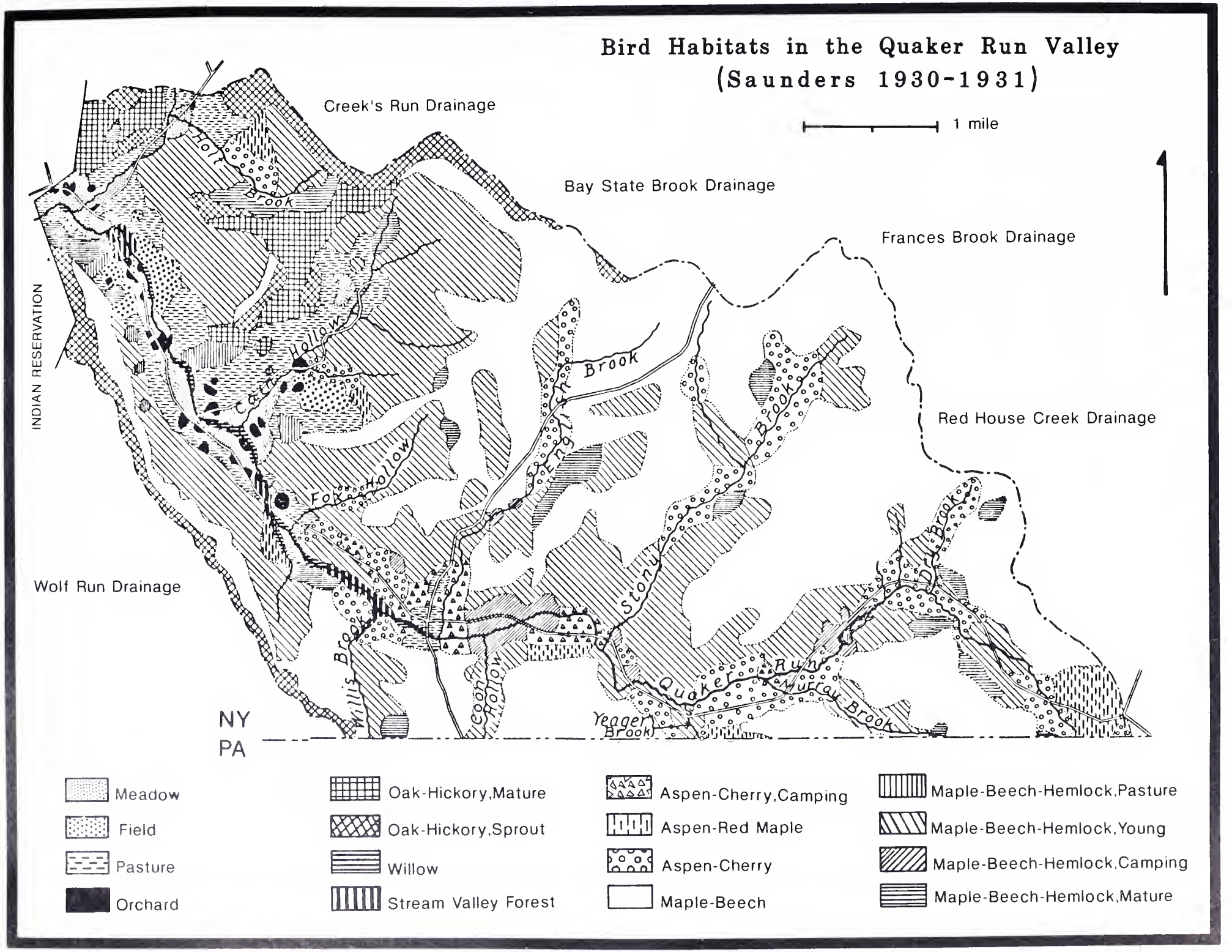

Bird Habitats in the Quaker Run Valley
(Saunders 1930-1931)
1 mile
Creek's Run Drainage
Bay State Brook Drainage
Frances Brook Drainage
Red House Creek Drainage
Wolf Run Drainage
INDIAN RESERVATION
NY
PA
Holt Brook
Cattail Hollow
Fox Hollow
Willis Brook
Coon Hollow
Yeager Brook
Stony Brook
Quaker Run
Murray Brook
Meadow
Field
Pasture
Orchard
Oak-Hickory,Mature
Oak-Hickory,Sprout
Willow
Stream Valley Forest
Aspen-Cherry,Camping
Aspen-Red Maple
Aspen-Cherry
Maple-Beech
Maple-Beech-Hemlock,Pasture
Maple-Beech-Hemlock,Young
Maple-Beech-Hemlock,Camping
Maple-Beech-Hemlock,Mature

Table 1.

Comparison of habitats for the two census periods (1930-1931 and 1983-85) covered in this report.

1930-1931 Habitats		
Lake	8 acres	3 hectares
Meadow	352 acres	142 hectares
Field	238 acres	96 hectares
Pasture	1051 acres	425 hectares
Orchard	50 acres	20 hectares
Mature Oak-Hickory	503 acres	204 hectares
Sprout Oak-Hickory	618 acres	250 hectares
Mature Maple-Beech-Hemlock	504 acres	204 hectares
Pastured Maple-Beech-Hemlock	121 acres	49 hectares
Young Maple-Beech-Hemlock	4793 acres	1940 hectares
Camping Maple-Beech-Hemlock	176 acres	71 hectares
Maple-Beech	6850 acres	2772 hectares
Stream Valley Forest	42 acres	17 hectares
Aspen-Cherry	1166 acres	472 hectares
Camping Aspen-Cherry	123 acres	50 hectares
Aspen-Red Maple	333 acres	135 hectares
Willow	39 acres	16 hectares
Total:	16967 acres	6866 hectares
1983-1985 Habitats		
Lake	279 acres	113 hectares
Meadow	32 acres	13 hectares
Field	192 acres	78 hectares
Thicket	440 acres	178 hectares
Willow Thicket-Beaver Meadow	162 acres	66 hectares
(Mature) Oak -Hickory Forest	2088 acres	845 hectares
(Mature) Maple-Beech-Birch-Hemlock	6990 acres	2829 hectares
(Mature) Maple-Beech-Cherry	6489 acres	2626 hectares
Stream Valley Forest	34 acres	14 hectares
Plantation	94 acres	38 hectares
Recreation-Administration Areas	190 acres	77 hectares
Total:	16990 acres	6877 hectares

Methods

I attempted to repeat Saunders' study as it was done in 1930-31. The methods I used to collect data in 1983-85 follow those described by Saunders (1936) and are presented below.

Collection of data began 1 July and continued daily through 15 July. Saunders was aware that the study dates were late for a breeding bird census. Other activities prevented his arrival at Allegany State Park before July. Field work in 1983-85 was limited to morning between the hours of 5:30 a.m. and 10:30 a.m. (Eastern Daylight Savings Time). Saunders (1936) emphasized the need to make counts in the early morning before many birds stopped singing and made the counts inaccurate.

Each census consisted of recording the number and species of singing male birds observed within a belt transect 500 feet (152m) wide. When a route passed through two or more habitats, the birds were recorded accordingly. Birds counted were those observed within 250 feet (76 m) of a paced line. Saunders used triangulation to verify whether a questionable bird was within the census transect. Saunders' method of triangulation was contingent upon the singing bird maintaining its position and continuing to sing while 250 feet were paced along the census line. I rarely encountered birds that I felt required triangulation to confirm their location in the census transect. I disregarded the few questionable birds.

The area censused in each habitat was determined by counting paces of known length. Thus, I surveyed 10 acres (4 ha) for every 164 double paces along the transect line. It was necessary for me to use judgment and adjust my count of paces when rough terrain altered my stride.

I determined the location of each census route on a 7.5 minute topographic map (United States Geological Survey: Red House, New York, 1962 and Limestone, New York, 1961; also see Figure 3). The route was followed in the field with map and compass. The location of the census routes was influenced by the arrangement of habitats and Saunders' instruction to travel up or down a mountain whenever possible. Other considerations for location of routes were an easily accessible starting point and placement to provide thorough coverage of the study area.

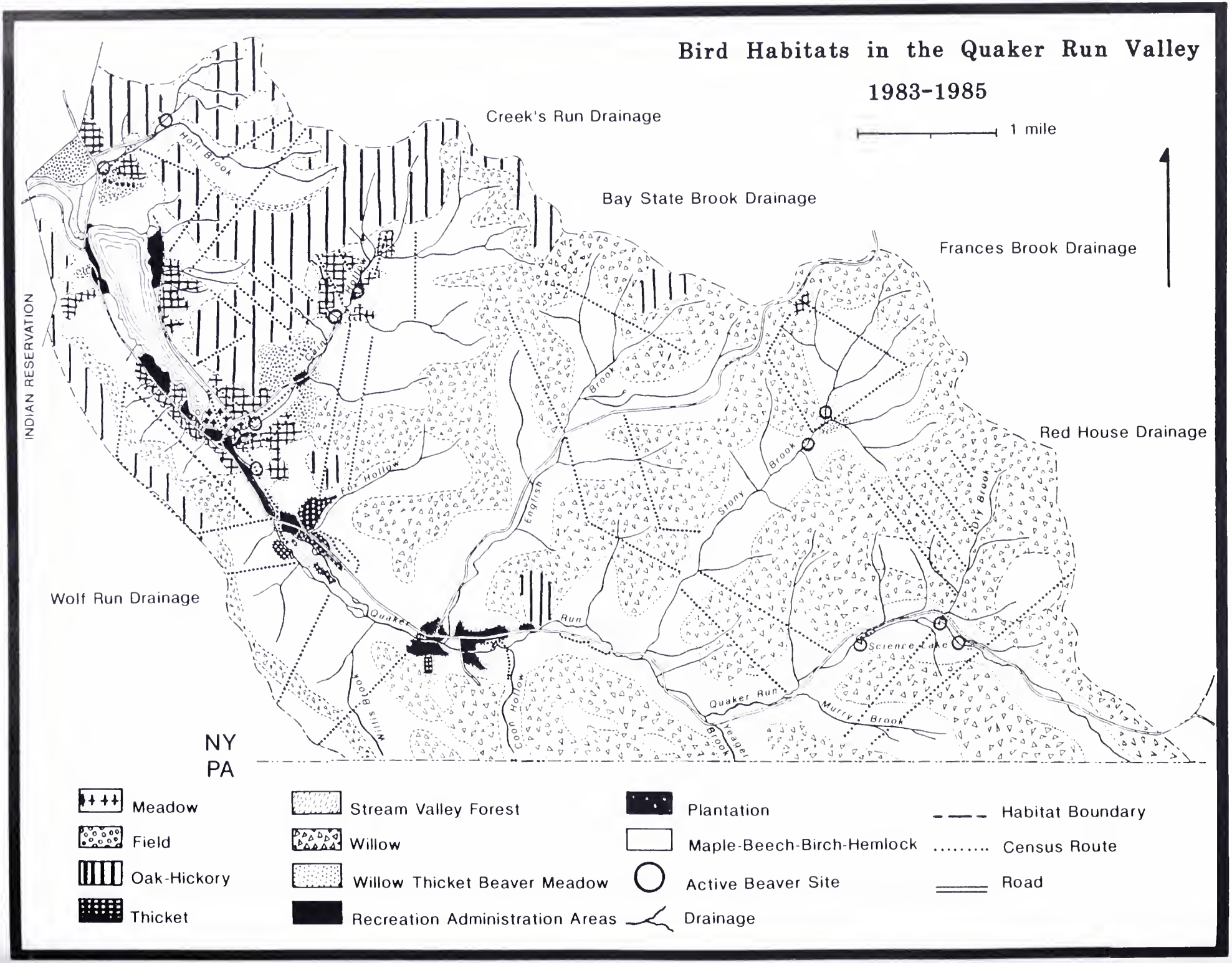
The selection of habitats was governed by an attempt to correspond to those described by Saunders (1936). Because of vegetational changes, the 1930-31 and 1983-85 habitats differ to varying degrees. The demarcation of the 1983-85 habitats relied heavily upon the 1980 vegetation cover map of Allegany State Park, Saunders' map (see Figure 2), and personal observation. Figure 3 shows the 1983-85 bird habitats as I determined them.

The total acreage of each bird habitat in the study area was determined by Saunders (1936) by use of a planimeter. I determined the acreage of the habitats in Figure 3 from a 1:24,000 scale map by overlaying an acetate sheet marked with a grid of squares to a scale of 6.4 acres (2.6 ha) per square (Table 1).

There are several variables that affect the accuracy of data collected using the methods in this study. Breeding bird population censuses based upon a count of singing males can be affected by singing of unmated birds, adjustments of song to different periods of the nesting cycle, and the amount of song exhibited by a species (Kendeigh, 1944). Variations in observer skills, weather conditions, the density of habitat, and misjudged distances also affect transect counts (Emlen, 1971). Clark and Clark (1984) evaluated Kendeigh's (1944) criticism of Saunders' belt transects as too wide for accurate counts. Clark and Clark found that Saunders' data from the 1936 study collected by belt transects in beech-maple-hemlock forest compared very closely to data Saunders collected by territory mapping (Saunders, 1938) in similar habitat. While one observer and the same geographic location helped account for the close similarity in Saunders' two studies, Clark and Clark found that Saunders' 1938 data were also similar to data collected by other observers (Kendeigh, 1946; Keller, 1980) using the same methods in similar habitat.

The data are presented in the tables as the number of pairs of breeding birds, rounded to the nearest tenth, per 100 acres (40 ha) of habitat surveyed. The values for the nesting densities of species, rounded to the nearest hundreth, are applied to the total acreage of the habitat in the study area to calculate the figure for the number of pairs of each species in a habitat. The figure for total pairs of all species in a habitat is the sum of the pairs for each species in the habitat. I followed Saunders' (1936) method to calculate the total nesting density for each habitat using the total pairs figure and the acreage of the habitat rather than adding the individual species' nesting densities. My tables include Saunders' (1936) data from the 1930-31 habitat with conditions most similar to the 1983-85 habitat.

Like Saunders (1936), I found it necessary to modify the estimates for some species based upon my knowledge of those species in Allegany State Park. For rare or limited distribution species, I believe I had a direct count. These species are: Green-backed Heron, Wood Duck, Mallard, Spotted Sandpiper, Northern Saw-whet Owl, Belted Kingfisher, Tree Swallow, Northern Rough-winged Swallow, Cliff Swallow, Barn Swallow, American Crow, European Starling, Northern Parula, Yellow-throated Warbler, Northern Cardinal, Savannah Sparrow, Swamp


Bird Habitats in the Quaker Run Valley
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1 mile
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INDIAN RESERVATION
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Dry Brook
Quaker Run
Science Lake
Willis Brook
Coon Hollow
Yeager Brook
Murry Brook
Meadow
Field
Oak-Hickory
Thicket
Stream Valley Forest
Willow
Willow Thicket Beaver Meadow
Recreation Administration Areas
Plantation
Maple-Beech-Birch-Hemlock
Active Beaver Site
Drainage
Habitat Boundary
Census Route
Road

Sparrow, Bobolink, Eastern Meadowlark, and Northern Oriole. My figures for the following species are based upon encounters during the censuses and adjustments to what I feel is their representation in the Quaker Run valley: all hawks, Wild Turkey, American Woodcock, Barred Owl, Pileated Woodpecker, and Common Grackle.

Weather conditions during the census period for 1983 and 1984 did not affect field work, but heavy rain prevented some censusing in 1985. Weather conditions delayed the nesting season in 1984 for many species (Spahn, 1984).

Warm and dry conditions prevailed prior to the 1985 census (Eaton, 1985a; 1985b) and may have resulted in an early completion of nesting. The contrast of weather during the 1984 and 1985 nesting seasons may help explain density declines greater than 50 percent recorded in 1985 for Yellow Warbler, Blackburnian Warbler, Cerulean Warbler, and Winter Wren. Data from the three census years are averaged to moderate yearly variabilty in the nesting cycle.

Habitat Descriptions

Koten (1981) described the forests of Allegany State Park as generally even-aged with no stands less than 50 years old. He stated there is little sapling age class and a lack of understory. When Saunders (1936) categorized the forests in the Quaker Run valley, young forest was common. The young forests of 1930-31 have succeeded to mature forests. With an exception of areas within the thicket habitat discussed below, there was no young forest in 1983-85.

As stated in the introduction, the white-tailed deer have had a significant impact on the forests in Allegany State Park. Severinghaus (1956) indicated that the deer entered the Park around 1920 and by 1938 were causing overbrowsing of hemlock and other vegetation. This placed Saunders' 1930-31 censuses at a time when the deer had not affected the understory of the forests. By the 1950s, Severinghaus noted severe effects from deer browsing, a situation that continues today (Eaton and Schrot, 1987; Koten, 1981). The hobblebush (*Viburnum lantanoides*)[1] is an indicator of the changes in the understory of forested habitats since Saunders' era. This species was the most common shrub of the mature maple-beech forest in the early decades of Allegany State Park (Taylor, 1928; Gordon *et al.*, 1937). Hobblebush was rare in Allegany State Park in 1983-85 (pers. obs.). Severinghaus (1956), Hough (1965), and Eaton and Schrot (1987) related the reduction of this and other shrubs to the browsing activities of deer.

Oak-Hickory Forest

This forest (Figure 4) is associated with the slopes and higher elevations of the lower Quaker Run valley adjacent to the Allegheny River valley and is representative of the oak forest described by Eaton and Schrot (1987). White oak (*Quercus alba*), red oak (*Q. rubra*), chestnut oak (*Q. montana*), and white pine (*Pinus strobus*) are characteristic of this forest. Hickory (*Carya* spp.) is present to a limited extent.

Gypsy moth (*Lymantria dispar*) larvae were causing defoliation of oaks and other trees in this habitat in 1984 and 1985 (pers. obs.). An increase in Black-billed and Yellow-billed Cuckoos was attributed to the irruption of the gypsy moth (pers. obs.; Eaton 1985b). My observations in the study area and nearby showed several bird species fed on one or more stages in the life cycle of the gypsy moth. In addition to both cuckoos, I observed that Wild Turkey, Downy Woodpecker, Blue Jay, Black-capped Chickadee, House Wren, American Robin, Gray Catbird, European Starling, Red-Eyed Vireo, Yellow Warbler, Rose-breasted Grosbeak, Rufous-side Towhee, Chipping Sparrow, Common Grackle, and Northern Oriole fed on the gypsy moth. McAtee (1926) and Forbush (1907) recorded predation on the gypsy moth by additional bird species. Holmes *et al.* (1986) and Holmes and Sherry (1988) discussed the importance that changes in abundance of food on a local scale had on bird populations in temperate deciduous forest in New Hampshire.

Figure 4

Windfalls in the oak-hickory forest on a ridge dividing Holt Brook from Creeks Run in Allegany State Part, New York, 7 July 1984. Elevation ca. 2220 feet (677 m). A pair of Indigo Buntings nested at this site, and nearby a Black-throated Blue Warbler sang on its territory.

What changes, if any, the gypsy moth irruption in the Quaker Run valley caused in the bird populations, other than the cuckoos, were not apparent.

Estimated pairs of birds breeding in 2,088 acres (845 ha) of mature oak-hickory forest are given in Table 2. The large increases in the nesting densities of the American Redstart and Blackburnian Warbler are attributed to the recovery and expansion of the mature oak-hickory forest in the study area since 1930-31. Eaton (1981) reported the American Redstart as common in oak woods. The open subcanopy provided space for the flycatching habits of the American Redstart

[1] The plant binomials used in this paper are those given in Mitchell, 1986

Table 2.

Birds of the Oak-Hickory Forest.

Species	Average pairs per 100 acres		1983-85 Total Pairs
	1983-85	1930-31	
American Redstart	15.3	2.1	320
Red-eyed Vireo	14.6	15.4	306
Blackburnian Warbler	6.7	1.3	139
Hooded Warbler	5.0	1.4	105
Veery	4.6	0.0	98
Ovenbird	4.6	14.6	96
Cerulean Warbler	4.1	0.0	87
Eastern Wood-Pewee	3.8	5.6	80
Least Flycatcher	3.2	0.0	66
Scarlet Tanager	3.0	3.8	63
White-breasted Nuthatch	2.7	3.1	56
Wood Thrush	2.4	7.4	51
Hairy Woodpecker	1.2	2.7	25
Hermit Thrush	0.7	1.2	14
Solitary Vireo	0.6	0.0	13
Yellow-throated Vireo	0.6	Irregular	13
Brown Creeper	0.5	0.0	11
Black-capped Chickadee	0.5	4.6	10
Black-throated Blue Warbler	0.5	10.3	10
Northern Flicker	0.4	4.4	8
Dark-eyed Junco	0.4	4.2	8
Rose-breasted Grosbeak	0.3	0.0	7
Black-billed Cuckoo	0.3	0.0	6
Yellow-bellied Sapsucker	0.3	0.0	5
Downy Woodpecker	0.3	0.0	5
American Robin	0.3	0.0	5
Indigo Bunting	0.2	0.0	5
Wild Turkey	0.1	0.0	2
Black-and-white Warbler	0.1	8.6	2
Chipping Sparrow	0.1	0.0	2
Brown-headed Cowbird	0.1	0.0	2
Cooper's Hawk	—	0.0	1
Red-tailed Hawk	—	0.9	1
Red-shouldered Hawk	0.0	0.2	0
Barred Owl	0.0	0.2	0
Eastern Screech-Owl	0.0	0.4	0
Ruffed Grouse	0.0	0.9	0
Blue Jay	0.0	3.7	0
American Crow	0.0	4.1	0
Magnolia Warbler	0.0	9.2	0
Black-throated Green Warbler	0.0	12.4	0
Total:	77.7	121.6	1622

(Eaton, 1981; Sherry, 1979) and the Least Flycatcher (Sherry, 1979). The regular occurrence of the Blackburnian Warbler away from conifers (pers. obs.) in this habitat suggested that this species, like the Cerulean Warbler, used the high canopy of the large oaks for nesting, a behavior reported by Harrison (1984) for the Blackburnian Warbler in the southern part of its range.

Saunders (1936) found Magnolia, Black-throated Green and Blackburnian Warblers associated with white pines in the mature oak forest. Koten (1981) discussed the current status of conifers in Allegany State Park and reported the absence of young conifers as a result of overbrowsing by deer and the absence of regeneration cuts. Large white pines were present in 1983-85 but generally scattered and susceptible to wind damage (pers. obs.). As discussed above, the Blackburnian Warbler has apparently made an adjustment to the changes in conifers. The Magnolia Warbler and Black-throated Green Warbler declines in the oak-hickory may be related to the changes in the white pines.

The large decline in nesting density for the Black-throated Blue Warbler in this habitat, which is even more pronounced in the maple-beech forest, is likely a result of the poorly developed shrub and sapling component of the habitat. Marked nesting density declines for the Ovenbird and Black-and-White Warbler may also be a result of the condition of the understory.

Maple-Beech Forest

The largest habitat in the Quaker Run valley is the extensive maple-beech forest. Saunders (1936) divided the maple beech forest into several categories (see Table 1) based upon the occurrence of eastern hemlock (*Tsuga canadensis*), age of the forest, and use by humans or animals. Because of changes in this forest, I consider the maple-beech forest as two distinct habitats without additional subdivisions. I have labeled the maple-beech forest with a significant hemlock component the maple-beech-birch-hemlock habitat. Where hemlock is rare, I have called the maple-beech forest the maple-beech-cherry habitat.

MAPLE-BEECH-BIRCH-HEMLOCK HABITAT

Within the maple-beech-birch-hemlock habitat (Figures 5, 6), hemlock and its associate the yellow birch (*Betula alleghanensis*) grow commonly in the moist, shaded stream valleys and decline rapidly with elevation and drier conditions. Saunders' (1936) maple-beech-hemlock forest was predominantly a young forest, and areas with mature trees were small and discontinuous. The 1983-85 maple-beech-birch-hemlock habitat is generally mature trees and contiguous. Table 3 gives the figures for nesting birds in 6,990 acres (2,829 ha) of maple-beech-birch-hemlock.

My data for the mature maple-beech-birch-hemlock habitat reveal an overall decrease in nesting densities when compared with Saunders' (1936) data from mature maple-beech-hemlock forest, but an increase in the number of species from 25 in 1930-31 to 47 in 1983-85. The increase in acreage from 504 acres (1930-31) to 6990 acres (1983-85) is undoubtedly a factor in the increase in number of nesting species.

Figure 5

This area is within the maple-beech-birch-hemlock habitat near a small tributary of the Quaker Run about 0.5 mile (0.8 km) west of Science Lake in Allegany State Park, New York, 9 July 1984. Elevation ca. 1900 feet (579 m). The dense shade cast by the hemlock trees combined with heavy foraging by deer result in the absence of ground vegetation.

Pair densities of the understory and ground nesting species are much reduced since 1930-31. The absence of the Black-throated Blue Warbler and the presence of the Least Flycatcher, American Robin, and Chipping Sparrow are indicative of the open understory found in this habitat in 1983-85.

There are seven species recorded for this habitat in 1983-85 that were not on Saunders' (1936) list of breeding birds in the Quaker Run valley: Northern Goshawk, Broad-winged Hawk, Northern Saw-whet Owl, Yellow-bellied Sapsucker, Acadian Flycatcher, Yellow-throated Warbler and Louisiana Waterthrush. Of these, the Northern Goshawk, Broad-winged Hawk, and Yellow-bellied Sapsucker likely occur as a consequence of the maturity and expanded size of the forest. The Breeding Bird Atlas of New York State documents range expansions for

Table 3.

Birds of the Mature Maple-Beech-Birch-Hemlock Habitat.

Species	Average Pairs per 100 acres		1983-85 Total Pairs
	1983-85	1930-31	
Red-eyed Vireo	16.1	21.2	1126
Black-throated Green Warbler	6.2	24.2	433
Dark-eyed Junco	5.9	13.5	410
Magnolia Warbler	4.9	28.8	347
Blackburnian Warbler	4.9	8.7	344
American Redstart	4.1	4.4	291
Ovenbird	2.9	18.9	206
Wood Thrush	2.7	6.6	188
Black-capped Chickadee	2.1	0.0	144
Yellow-bellied Sapsucker	2.0	0.0	140
American Robin	2.0	0.0	137
Least Flycatcher	1.8	0.0	124
Solitary Vireo	1.7	6.4	121
Veery	1.5	0.0	102
Scarlet Tanager	1.3	4.0	92
White-breasted Nuthatch	1.2	2.3	82
Brown Creeper	1.1	0.0	75
Hermit Thrush	1.0	0.0	67
Chipping Sparrow	1.0	0.0	66
Acadian Flycatcher	0.8	0.0	54
Hooded Warbler	0.7	3.2	52
Rose-breasted Grosbeak	0.7	0.0	51
Swainson's Thrush	0.6	5.2	44
Hairy Woodpecker	0.6	4.1	41
Winter Wren	0.6	2.7	40
Eastern Wood-Pewee	0.5	1.6	38
Mourning Warbler	0.5	0.0	34
Downy Woodpecker	0.3	0.0	23
Ruffed Grouse	0.2	0.0	15
Northern Flicker	0.2	3.2	11
Black-billed Cuckoo	0.1	0.0	7
Blue Jay	0.1	2.4	7
Canada Warbler	0.1	0.0	7
Ruby-throated Hummingbird	0.1	0.0	4
American Crow	0.1	3.8	4
Chestnut-sided Warbler	0.1	0.0	4
Louisiana Waterthrush	0.1	0.0	4
Indigo Bunting	0.1	0.0	4
Brown-headed Cowbird	0.1	0.0	4
Sharp-shinned Hawk	—	0.0	2
Barred Owl	—	0.6	2
Northern Goshawk	—	0.0	1

Table 3 continued

Species	Average Pairs per 100 acres 1983-85	1930-31	1983-85 Total Pairs
Red-shouldered Hawk	—	0.6	1
Broad-winged Hawk	—	0.0	1
Red-tailed Hawk	—	0.4	1
Northern Saw-whet Owl	—	0.0	1
Yellow-throated Warbler	—	0.0	1
Black-and-white Warbler	0.0	1.8	0
Chimney Swift	0.0	2.0	0
Black-throated Blue Warbler	0.0	10.7	0
Total:	70.8	182.2	4953

Figure 6

This small brook runs through the maple-beech-birch-hemlock habitat approximately 0.5 mile (0.8 km) east of the entrance to Cain Hollow Campground in Allegany State Park, New York, 3 July 1984. Elevation ca. 1740 feet (530 m). This location is typical habitat for the Acadian Flycatcher.

these three species that are attributed to the recovery of large tracts of forest in the State (Andrle and Carroll, 1988). The Acadian Flycatcher and Louisiana Waterthrush, according to Eaton (in Andrle and Carroll, 1988), have re-established themselves as the habitat along streams recovered from the effects of logging. A nesting pair of Yellow-throated Warbler was one of two nesting pairs in New York State in 1984, establishing the first confirmed nesting in the State for this species (Baird, 1984). Carroll (in Andrle and Carroll, 1988) noted the northward expansion of the Yellow-throated Warbler. Although the Northern Saw-whet Owl was not recorded in 1930-31 by Saunders, he did report its presence in 1933 (Saunders, 1942). This owl is easily overlooked and, like the Yellow-throated Warbler, its presence is probably not dictated by habitat changes since 1930-31.

Cabins for park visitors are within the maple-beech-birch-hemlock habitat near the Quaker Run. Birds in the cabin areas are those tolerant of human activities. Blue Jays, American Crows, and Common Grackles frequent the cabin areas in July to scavenge refuse, but they undoubtedly nest elsewhere. Eastern Phoebes nest on the outside of the cabins (pers. obs.) and American Robins find attractive foraging conditions around the cabins.

MAPLE-BEECH-CHERRY HABITAT

The maple-beech-cherry habitat (Figures 7, 8) occurs at higher elevations where dry conditions prevail. A sharp boundary separates it from the hemlock forest below. A layer of conglomerate rock occurring between shale beds is responsible for a spring horizon at middle elevations (Lobeck, 1927; Saunders, 1936). The dry conditions above the spring horizon eliminate most of the hemlock and yellow birch. This habitat is essentially Saunders' (1936) "maple-beech sprout" after more than 50 years of growth.

The maple-beech-cherry habitat is uniform over extensive areas. It is characterized by mature trees and a poorly developed understory. Heterogeneity occurs where large trees are blown down and tree saplings, blackberry (*Rubus* spp.) and other low vegetation respond to

Figure 7

Windfall in the maple-beech-cherry habitat on a southeast slope of Mt. Onondaga, 0.5 mile (0.8 km) west of Stony Brook, Allegany State Park, New York, 4 July 1984. Elevation ca. 2060 feet (628 m). A dense shrub growth of blackberry (*Rubus* sp.) and red elderberry (*Sambucus racemosa*) attracted the Winter Wren, Mourning Warbler, and Canada Warbler to this site.

Figure 8

Maple-beech-cherry habitat with an understory of red elderberry on a ridge dividing the headwaters of English Brook from Cain Hollow in Allegany State Park, New York, 10 July 1984. Elevation ca. 2220 feet (677 m). Birds observed in this area include the Chestnut-sided Warbler, Black-throated Blue Warbler, Mourning Warbler, Hooded Warbler, and Indigo Bunting.

increased light. The black cherry (*Prunus serotina*) generally replaces the American beech (*Fagus grandifolia*) as an associate of sugar maple (*Acer saccharum*) to the east of a line approximated by Stony Brook (Figure 3). Beech trees show an infestation by the beech blight (*Nectria coccinea* var. *fagi*) (Eaton and Schrot, 1987). In 1983-85 tree mortality was low, a situation that has since begun to change (pers. obs.). A large mortality in beech trees would bring more heterogeneity to this forest, a loss of the beechnut mast crop, and likely other consequences that will affect birds.

This habitat covers 6,489 acres (2,626 ha). Table 4 provides the results of the bird census in the maple-beech-cherry habitat. Saunders' (1936) data for the maple-beech sprout are included in Table 4, but conditions have changed to a degree that the habitat in 1983-85 shows little similarity to the former habitat.

The Least Flycatcher, American Robin, American Redstart, and Chipping Sparrow are species indicative of the openness of the understory in this habitat. Saunders (1938) reported that the Least Flycatcher preferred open forests as did Johnston (1971). Saunders (1938) said the Chipping Sparrow was not a species of the natural maple-beech forest.

In this habitat, Swainson's Thrushes, Magnolia Warblers and Blackburnian Warblers are restricted to the few, scattered hemlocks. The Black-throated Green Warbler was encountered regularly in 1983-85 in areas lacking any hemlock. Kendeigh (1946) observed a similar phenomenon with the Black-throated Green Warbler in maple-beech forest in eastern New York State. He observed that the Black-throated Green Warbler increased in areas lacking conifers, while the Blackburnian Warbler disappeared along with the hemlocks.

Stream Valley Forest

Much of what Saunders (1936) hesitatingly classified as stream valley forest occupied an area that is now part of Quaker Lake. Saunders described this forest as differing only slightly from the maple-beech-hemlock forest and was characterized by the presence of elm (*Ulmus americana*).

In 1983-85 this label is used in reference to a small extent of forest adjacent to the Quaker Run above Quaker Lake. It was a varied habitat with a few tall trees and dead elm snags interspersed within a tangle of low to moderate height vegetation. The habitat was quite moist and included a blend of conditions found in the thicket, willow thicket-beaver meadow, and maple-beech-birch-hemlock habitats of 1983-85.

The figures given in Table 5 are total pair estimates for the birds in 34 acres (14 ha) of stream valley forest. Saunders' (1936) figures for stream valley forest are included in Table 5, although the 1930-31 habitat differed significantly from the 1983-85 stream valley forest.

The Northern Parula and Northern Cardinal were found only in this habitat in 1983-85. Each is represented by a single observation, which suggests that they were irregular in the study area. Saunders (1942) called each of these species rare in Allegany State Park. The Northern Cardinal, unlike the Northern Parula, has changed status since 1930-31 in southwestern New York State, where it is now common outside of contiguous forest (Eaton, 1981).

Plantation

During Saunders' era in Allegany State Park, some areas of open land were planted with conifers, principally white pine (*Pinus strobus*), red pine (*P. resinosa*), Scotch pine (*P. sylvestris*), and Norway spruce

Table 4.

Birds of the Maple-Beech-Cherry Habitat.

Species	Average Pair per 100 acres 1983-85	1930-31	1983-85 Total Pairs
Red-eyed Vireo	17.1	8.3	1112
American Redstart	6.4	0.7	418
Black-throated Green Warbler	4.4	7.4	288
Least Flycatcher	3.5	0.0	231
Chipping Sparrow	3.5	0.0	225
Hooded Warbler	3.2	0.0	210
American Robin	3.2	4.8	206
Dark-eyed Junco	3.0	0.0	193
Veery	2.9	0.0	188
Wood Thrush	2.8	0.0	179
White-breasted Nuthatch	2.3	0.0	145
Ovenbird	2.1	5.4	139
Yellow-bellied Sapsucker	2.1	0.0	137
Rose-breasted Grosbeak	1.7	1.1	112
Scarlet Tanager	1.5	1.9	96
Brown Creeper	1.4	0.0	93
Mourning Warbler	1.4	0.0	91
Hermit Thrush	1.3	0.0	85
Hairy Woodpecker	1.2	1.6	75
Blackburnian Warbler	1.1	0.0	71
Black-capped Chickadee	1.0	4.0	60
Eastern Wood-Pewee	0.9	0.0	55
Downy Woodpecker	0.5	0.0	33
Black-throated Blue Warbler	0.5	0.8	31
Swainson's Thrush	0.3	0.0	21
Northern Flicker	0.3	0.0	18
Winter Wren	0.3	0.0	18
Solitary Vireo	0.2	0.4	15
Indigo Bunting	0.2	0.0	15
Chestnut-sided Warbler	0.1	0.0	9
Ruffed Grouse	0.1	0.0	6
Blue Jay	0.1	1.4	6
Brown-headed Cowbird	—	0.0	4
Black-billed Cuckoo	—	0.0	3
Barred Owl	—	0.0	3
Ruby-throated Hummingbird	—	0.0	3
Magnolia Warbler	—	1.8	3
Louisiana Waterthrush	—	0.0	3
Pileated Woodpecker	—	0.0	2
Red-shouldered Hawk	—	0.0	1
Red-tailed Hawk	—	0.0	1
Cedar Waxwing	0.0	0.5	0
Total:	71.0	40.1	4604

Table 5.

Birds of the Stream Valley Forest.

Species	Estimated total pairs 1983-85	1930-31
Common Yellowthroat	2	0
Indigo Bunting	2	0
Song Sparrow	2	0
Ruby-throated Hummingbird	1	0
Downy Woodpecker	1	0
Northern Flicker	1	4
Eastern Phoebe	1	0
Eastern Kingbird	1	0
Blue Jay	1	3
Black-capped Chickadee	1	6
House Wren	1	0
Veery	1	5
Wood Thrush	1	1
Gray Catbird	1	0
Cedar Waxwing	1	3
Red-eyed Vireo	1	8
Northern Parula	1	0
Chestnut-sided Warbler	1	0
American Redstart	1	5
Mourning Warbler	1	0
Scarlet Tanager	1	4
Northern Cardinal	1	0
Rose-breasted Grosbeak	1	0
Northern Oriole	1	0
American Goldfinch	1	0
Eastern Wood-Pewee	0	5
White-breasted Nuthatch	0	4
Black-and-white Warbler	0	4
American Crow	0	4
American Robin	0	3
Hairy Woodpecker	0	3
Black-throated Green Warbler	0	2
Magnolia Warbler	0	2
Solitary Vireo	0	2
Dark-eyed Junco	0	2
American Woodcock	0	2
American Kestrel	0	1
1983-85 Totals:	25 species, 28 pairs,	82.4 pairs/100 acres
1930-31 Totals:	21 species, 73 pairs,	173.8 pairs/100 acres

(*Picea abies*) (Gordon *et al.* 1937). Saunders (1936) classified these areas as pasture because the small trees and open areas around them provided a similar bird habitat.

In 1983-85, these conifer plantings contained mature trees (Koten, 1981). The plantations occupy a few separated areas totaling approximately 94 acres (38 ha). Because the plantations were unlike any habitat of 1930-31, I did not census these areas. Plantations are of interest because they have attracted birds that would not otherwise be expected as nesting species in the Quaker Run valley. These species are Red-breasted Nuthatch, Golden-crowned Kinglet, and Yellow-rumped Warbler (Eaton, 1981 and pers. obs.). In addition to these species, Blue Jays, American Crows, Common Grackles, and Purple Finches probably are nesting in the plantations (pers. obs.).

The Open Areas

The open areas in 1930-31 were primarily a result of farming activity. An absence of farming for many years and the formation of Quaker Lake have significantly changed the character of the open areas since 1930-31. The open areas present in 1983-85 are here considered in comparison with those described by Saunders (1936).

MEADOW

The area near the inflow to Quaker Lake is similar to the meadow habitat described by Saunders (1936). There is considerable reduction in acreage since 1930-31 (Table 1), and the function is no longer related to agriculture. Periodic mowing of this habitat in 1983-85 maintained a variety of grasses.

The data in Table 6 are based on a direct count of the pairs nesting in this limited habitat of 32 acres (13 ha). The Vesper Sparrow was a common inhabitant in the meadow habitat in 1930-31. It no longer nests in the Quaker Run valley and its absence is discussed in the next section which considers the field habitat.

FIELD

Field habitat, as Saunders (1936) described it, was not represented in the study area in 1983-85. Habitat labeled as field was found in

Table 6.

Birds of the Meadow.

Species	Average pairs per 100 acres		1983-85 Total Pairs
	1983-85	1930-31	
Savannah Sparrow	18.8	16.0	6
Red-winged Blackbird	12.5	9.8	4
Eastern Meadowlark	9.4	8.0	3
Bobolink	6.3	0.9	2
Brown-headed Cowbird	3.1	2.8	1
Vesper Sparrow	0.0	9.8	0
Total:	50.0	45.3	16

Table 7.

Birds of the Field.

Species	Average pairs per 100 acres		1983-85 Total Pairs
	1983-85	1930-31	
Song Sparrow	46.1	0.0	89
Common Yellowthroat	15.9	0.0	31
Field Sparrow	3.7	0.0	7
Red-Winged Blackbird	1.6	0.0	3
Willow Flycatcher	0.5	0.0	1
Vesper Sparrow	0.0	8.8	0
Total:	68.2	8.8	131

Table 8.

Birds of the Thicket.

Species	Average pairs per 100 acres 1983-85	1983-85 Total Pairs
Rufous-sided Towhee	12.2	54
Field Sparrow	10.9	48
Common Yellowthroat	10.2	45
Gray Catbird	9.9	44
Song Sparrow	9.3	41
Indigo Bunting	5.8	25
American Redstart	5.0	22
Yellow Warbler	3.7	16
Black-capped Chickadee	3.1	14
Cedar Waxwing	3.0	13
Veery	2.7	12
Red-eyed Vireo	2.7	12
American Goldfinch	2.1	9
Rose-breasted Grosbeak	2.0	9
Chestnut-sided Warbler	1.9	8
Blue-gray Gnatcatcher	1.5	7
American Robin	1.4	6
Blue-winged Warbler	1.2	5
Nashville Warbler	1.1	5
Downy Woodpecker	1.1	5
Least Flycatcher	1.0	4
Blue Jay	0.8	3
American Woodcock	0.7	3
Ruffed Grouse	0.5	2
Black-billed Cuckoo	0.5	2
Yellow-billed Cuckoo	0.5	2
Willow Flycatcher	0.5	2
Black-and-white Warbler	0.5	2
Ovenbird	0.5	2
Scarlet Tanager	0.5	2
Chipping Sparrow	0.5	2
House Wren	0.4	2
Northern Flicker	0.2	1
Eastern Phoebe	0.2	1
White-breasted Nuthatch	0.2	1
Total:	98.0	431

scattered areas in 1983-85 and is somewhat variable in conditions. The field habitat in 1983-85 showed conditions intermediate between the open meadow and the dense, shrubby growth of thicket. Goldenrod (*Solidago* spp.), raspberry (*Rubus* spp.), milkweed (*Asclepias syriaca*), timothy (*Phleum pratense*), and widely scattered tree saplings are the common plants that occupied the dry sites representing field habitat.

Table 7 gives the estimated avian populations in 192 acres (78 ha) of field. The Vesper Sparrow was the only species Saunders found in his field habitat in 1930-31. Saunders (1936) described the field as dry, upland areas of sparse grasses and low growing weeds. The change in field habitat since 1930-31 probably accounts for the absence of the Vesper Sparrow. This species showed declines on breeding bird surveys in Cattaraugus County (Eaton 1981), western New York State (Klabunde, 1986; Klingensmith and Hoover, 1986) and in New York State overall (Andrle and Carroll, 1988). This decline may be related to a loss of nesting habitat through changes in agricultural practices (Eaton, 1981; Andrle and Carroll, 1988).

THICKET

The thicket in 1983-85 resulted from the slow reforestation of areas formerly in pasture or open for other agriculture. The reversion to true forest has not yet occurred. Gordon *et al.* (1937) suggested that the formation of a grass sod during grazing slowed natural reforestation.

I have labeled this habitat a thicket because the plant growth in most areas is dense. Hawthorns (*Crataegus* spp.) are a common tree in this habitat. A variety of other small trees and saplings also occur, with red maple (*Acer rubrum*) and white ash (*Fraxinus americana*) as common species. Dogwood (*Cornus* spp.) grow in dense patches in the thicket. Some areas had a significant grass and goldenrod component that provided interspersed openings. There were 440 acres (176 ha) of thicket habitat in 1983-85.

The thicket habitat in 1983-85 exhibited characteristics in common with the pasture and sprout oak-hickory habitats described by Saunders (1936). In some areas, the young forest conditions of the temporary aspen forests of 1930-31 were found in the thicket. None of those 1930-31 bird habitats was a distinct unit in the study area during my censuses.

Because the vegetation was dense, a direct transect through the thicket habitat was rarely possible. Data collection under such circumstances lead to a greater potential for inaccurate species density figures in this habitat than in the open and forested habitats. The composition of species and their relative densities in the thicket habitat are believed to be more reliable than species densities.

The figures for birds of the thicket are given in Table 8. There is little of value in comparing the data in Table 8 with data Saunders accumulated for any single habitat, although the information indicates some noteworthy changes have occurred since 1930-31. Saunders (1942) did not report the Blue-winged Warbler or Blue-gray Gnatcatcher as occurring in Allegany State Park. Beardslee and Mitchell (1965), Eaton (1981), and Andrle and Carroll (1988) document the range expansions of these two species since Saunders' era. A Brewster's Warbler was observed in the thicket habitat and the presence of this hybrid between Blue-winged and Golden-winged Warblers suggests the presence of the Golden-winged Warbler. The Golden-winged Warbler, though not observed in the study area in 1983-85, was regular, but uncommon, in nearby areas (pers. obs.). Saunders (1942) considered the Golden-winged Warbler primarily a migrant. In 1930-31, Saunders recorded the Whip-poor-will in the sprout oak-hickory habitat (1.6 pairs per 100 acres) which he described (Saunders, 1936) as more of a thicket than a forest. No observations of the Whip-poor-will were made in any habitat of the Quaker Run valley in 1983-85, and it is now nearly absent from western New York as a nester (Andrle and Carroll, 1988).

WILLOW THICKET-BEAVER MEADOW

Saunders (1936) classified the willow areas bordering streams as temporary forest. Most of the willow habitat (Figure 9) has been modified by the activities of beavers which have increased greatly in Allegany State Park in recent times (Koten, 1981). Willows (*Salix* spp.) associate with the wetlands that occur behind beaver dams and form a habitat that was not present in the Quaker Run valley in 1930-31. Sites occupied by beaver are indicated on Figure 3.

Figure 9

The willow thicket-beaver meadow habitat is characterized by scattered shrubs and small trees. This view is to the northeast in the lower Cain Hollow near the Quaker Run in Allegany State Park, New York, 14 July 1984. Elevation ca. 1400 feet (427m).

The thickness and shape of willow thicket-beaver meadow habitat made coverage by a belt transect difficult and the collection of data relied heavily upon visual observation. This difference in method for the census of willow thicket-beaver meadow may preclude a valid comparison of the total species densities between this habitat and the others within the study area. The willow thicket-beaver meadow habitat has the highest calculated total species density of any 1983-85 habitat. The data for 162 acres (66 ha) of the willow thicket-beaver meadow are given in Table 9.

Table 9.

Birds of the Willow Thicket — Beaver Meadow.

Species	Average Pairs per 100 acres		1983-85 Total Pairs
	1983-85	1930-31	
Common Yellowthroat	21.1	46.2	34
Song Sparrow	19.9	28.2	32
Gray Catbird	14.3	12.8	23
Yellow Warbler	10.9	61.5	18
American Goldfinch	6.9	0.0	11
Red-winged Blackbird	6.3	0.0	10
Willow Flycatcher	5.5	Irregular	9
American Robin	4.6	0.0	7
Eastern Kingbird	3.5	0.0	6
European Starling	3.1	0.0	5
Ruby-throated Hummingbird	2.7	0.0	4
Great Crested Flycatcher	2.7	0.0	4
Cedar Waxwing	2.2	0.0	4
Rose-breasted Grosbeak	2.0	0.0	3
Indigo Bunting	2.0	0.0	3
Northern Oriole	1.5	0.0	2
Eastern Phoebe	1.4	0.0	2
Northern Flicker	1.3	0.0	2
Tree Swallow	1.3	0.0	2
American Woodcock	1.2	5.1	2
Green-backed Heron	1.2	0.0	2
Swamp Sparrow	1.2	0.0	2
Veery	0.8	2.6	1
Downy Woodpecker	0.7	0.0	1
Black-capped Chickadee	0.7	0.0	1
Red-eyed Vireo	0.7	0.0	1
American Redstart	0.7	0.0	1
Wood Duck	0.6	0.0	1
Mallard	0.6	0.0	1
Total:	119.8	156.4	194

The willow thicket-beaver meadow habitat included all of the species Saunders (1936) listed for willow habitat (Table 9). Saunders' (1936, 1942) report of the Alder Flycatcher presumably referred to the now separated Willow Flycatcher (Eaton, 1981). The activities of beaver have provided good habitat and the Willow Flycatcher was regular in 1983-85.

The Eastern Kingbird, Great Crested Flycatcher, Northern Oriole, and European Starling were associated in 1983-85 with willow thicket-beaver meadow habitat and its vicinity. Saunders (1936) found these four species only in a habitat he labeled orchard and shade trees. The Wood Duck, Mallard, Green-backed Heron, and Tree Swallow were not on Saunders' (1936) list of breeding birds in the Quaker Run valley and were generally uncommon in Allegany State Park (Saunders, 1942). These four species indicate the influence beaver activity has had on the avifauna since 1930-31. In his discussion of the Wood Duck, Saunders (1942) predicted an increase in species attracted by water as beavers increased in the region.

Stream Borders

This habitat of gravel bars and stream banks provided nest sites for a few characteristic species. Quaker Run for a short distance above and below Quaker Lake supplied this open habitat. The area below Quaker Lake was subject to flooding by the Allegheny Reservoir. My count of the number of pairs of breeding birds associated with the stream border habitat is given in Table 10.

The reduction of the number of pairs since 1930-31 is likely a result of loss of habitat through the formation of Quaker Lake. The Killdeer was not seen during the 1983-85 study period. My observations of the area at other times indicate the Killdeer was present in this habitat.

Buildings

Saunders (1936) found the Chimney Swift, Eastern Phoebe, Cliff Swallow, Barn Swallow, and House Sparrow nesting on or in buildings. The bridge I-beam supports at the Quaker Lake dam had replaced barn walls and rafters for Cliff and Barn Swallow nest attachment since 1930-31. A mixed nesting colony of these swallows occupied the girders under the bridge and was estimated to contain 8 pairs of Cliff Swallows and 12 pairs of Barn Swallows. A few additional pairs of Barn Swallows nested on other Park buildings. Eastern Phoebes used the Park cabins for nesting in 1983-85. Chimney Swifts and House Sparrows were not observed during the present study, though Chimney Swifts occurred at Science Lake after the study period (pers. obs.).

Recreation-Administration Areas

This category included acreage around administrative and recreational buildings and other areas that were mowed regularly or had a high human impact. Birds were not counted in recreation-administration areas, which totaled 190 acres (77 ha).

Quaker Lake

The Quaker Lake and the nearby Allegheny Reservoir attracted a non-breeding population of Ring-billed Gulls in 1983-85. Common Mergansers and Great Blue Herons also visited Quaker Lake, but I observed no evidence for their nesting in the study area.

Table 10.

Birds of the Stream Border.

Species	Total pairs	
	1930-31	1983-85
Belted Kingfisher	4	2
Spotted Sandpiper	6	1
N. Rough-winged Swallow	2	1
Killdeer	4	0
Total:	16	4

Changes in

Breeding Bird Density Since 1930-31

The 1983-85 data estimate breeding birds in 16,427 acres (6648 ha) of habitat representing 96.7 percent of the study area. The remaining 3.3 percent includes 558 acres (226 ha) of lake, plantation and recreation-administration areas where counts were not made. My data estimate that about 12,000 pairs of breeding birds occurred in 1983-85 giving an average nesting density of 73.1 pairs per 100 acres (40 ha). Saunders' (1936) corresponding figure was 84.6 pairs per 100 acres (40 ha) and represented an estimate of over 14,300 pairs. Appendix I gives the estimated total breeding bird pairs for each species in 1983-85 and 1930-31.

An analysis of the species nesting in forested habitats shows a 14.5 percent nesting density decline since 1930-31. The data from the young aspen forests, which Saunders (1936) labeled temporary forest, are not included in these comparisons because the conditions in the aspen habitats were significantly different in 1930-31 and 1983-85. Open habitats show an increased average nesting density of 45 percent since 1930-31. However, the validity of the comparison for open habitats is reduced because of dissimilarities in conditions within the open habitats at the time of each study. The estimated increase in nesting density in open habitats has little influence on the total nesting density change because less than 5 percent of the total area was in open habitats in 1983-85. The data from open and forested habitats combined indicate that overall breeding bird densities declined by 13.6 percent since 1930-31.

Saunders' (1936) data suggested that older seres, with a developed understory, accommodate more nesting birds than early successional communities. Studies by Johnston and Odum (1956), Shurgart and James (1973), and Holt (1974) support this suggestion. Forest vegetational succession has followed two courses in the Quaker Run valley since 1930-31. The tree component has grown to maturity, and the understory vegetation has declined.

In addition to local habitat changes, species migrating away from the area are influenced by habitat changes along their migratory route and at their wintering grounds. Habitats are being rapidly altered in the American tropics. In the past 50 years, as much as half of all forest cover has been lost in major regions, and pesticides, including DDT, have been widely used (Rappole *et al.*, 1983). It is difficult to separate bird population changes related to conditions within the study area from changes that may be due to conditions birds encounter on migration or at their wintering grounds. Holmes *et al.* (1986) suggest our knowledge of the winter ranges of birds breeding in the northeastern United States is incomplete (see Gochfeld, 1979; Pashley and Martin, 1987), which further complicates potential conclusions about the influences that tropical habitat changes might have on birds from any one locality.

Appendix II lists all the bird species mentioned in this manuscript and indicates the species which Rappole *et al.* (1983) listed as nearctic migrants (species whose populations in part or entirely breed north of the Tropic of Cancer and winter south of that line). Some of the nearctic migrants noted in Appendix II are here considered, for comparative purposes, as nonmigrants to the neotropics because they have significant winter territory within the southern United States and occasionally further north (American Ornithologists' Union Checklist, 1983, see note Appendix II). None of this latter group is distinguished in Rappole *et al.* (1983) as having a high vulnerability to habitat changes occurring in the neotropics.

Table 11 shows nesting density changes relative to two variables: migrant status (modified from Rappole *et al.*, 1983) and average nest height (Harrison, 1975). The comparisons in Table 11 suggest that the nesting density decline in species selecting nest sites below 2 m is a result of some factor that is not affecting the group nesting above 2 m. I believe the scarcity of understory vegetation is a primary factor causing the difference in density change in the two groups based upon nest height. The disparity in nesting density changes between nearctic migrants and nonmigrants is not as large as the differences relative to nest height. If the density differences between migrants and nonmigrants are significant, the data suggest that the greater density decline in nonmigrants is not related to nest height, while the density decline in nearctic migrants appears strongly related to nest height.

Changes in the understory since 1930-31 provide an attractive explanation for the declines in low nesting species, but other factors may also be important. Allegany State Park in 1983-85 had a high raccoon (*Procyon lotor*) population and their predation of low nests may have been significant (Koten, 1981). Influences on the nesting birds by factors that are regional or occurring far beyond the study area are more difficult to evaluate. The next section of this study is devoted to discussing individual species and looking at their changes in the Quaker Run study area as well as trends documented for other areas.

Table 11.

Nesting Density Changes in Relation to Nest Height and Migrant Status in Forested Habitat of the Quaker Run Valley.

Species Category	Number of Species		Average Density Pairs/100 acres		Percent Density Change
	1930-31	1983-85	1930-31	1983-85	
Nearctic Migrants	21	29	60.1	54.2	-9.8
Nonmigrants	23	25	23.7	17.6	-25.7
All forest species Nest Sites Below 2 Meters	12	16	29.1	16.9	-41.9
All forest species Nest Sites Above 2 Meters	32	38	54.7	54.9	+0.4
Nearctic Migrants Nest Sites Below 2 Meters	8	12	21.5	11.4	-47.0
Nearctic Migrants Nest Sites Above 2 Meters	13	17	38.6	42.8	+10.9
Nonmigrants Nest Sites Below 2 Meters	4	4	7.6	5.5	-27.6
Nonmigrants Nest Sites Above 2 Meters	19	21	16.1	12.1	-24.8

Changes in

Selected Avian Species in the Quaker Run Valley

Species discussed in this section have population or nesting density changes since 1930-31 that reflect habitat change within the Quaker Run study area, or show changes that may indicate influences from factors beyond the study area.

Since the data for the 1983-85 study were collected, several publications have appeared that provide information on local and regional bird population trends. Klingensmith and Hoover (1986) summarized 15 years of The Allegany County Breeding Bird Survey (1970-85). Allegany County, New York, borders Cattaraugus County on the east. Klabunde (1986) summarized United States Fish and Wildlife Service Breeding Bird Surveys from western New York for the period 1967-1986, and Robbins *et al.* (1986) summarized the Fish and Wildlife Breeding Bird Surveys from 1965-79 in the United States and Canada. The results of New York State's 1980-1985 Breeding Bird Atlas Project (Andrle and Carroll, 1988) have provided much additional information on population trends for birds nesting in the Quaker Run valley.

Nearctic Migrants

These species are nearctic breeding birds that migrate to the neotropics to winter (see Appendix II).

Family Tyrannidae

EASTERN WOOD-PEWEE

The Eastern Wood-Pewee shows a slight nesting density increase when all forested habitats are compared in the two studies. This increase has occurred despite declines in nest density within mature oak-hickory and maple-beech-birch-hemlock in 1983-85. Declines for this species were noted by Klingensmith and Hoover (1986) and Robbins *et al.* (1988), while Sibley (*in* Andrle and Carroll, 1988) reported little change in abundance of the Eastern Wood-Pewee over the last century.

ACADIAN FLYCATCHER

This species was not present in 1930-31 and indications are that it has reestablished populations in southwestern New York following a period of decline coinciding with Saunders' era in Allegany State Park (see the discussion of maple-beech-birch-hemlock habitat in this report). In Allegany State Park, the Acadian Flycatcher inhabits hemlocks along streams. The recovery of this habitat from the disruptive effects of logging is the likely explanation for the presence of this flycatcher in 1983-85. Robbins *et al.* (1986) reported an increase in the Acadian Flycatcher on the Allegheny Plateau.

LEAST FLYCATCHER

The Least Flycatcher was not present in forested habitat in 1930-31. The open nature of the subcanopy of the forests in the Quaker Run valley in 1983-85 provided conditions attractive to this flycatcher, which was common. Johnston (1971) found a parklike, modified forest had the peak population density for the Least Flycatcher in southwestern Virginia. Andrle and Carroll (1988) showed this species generally abundant in New York State.

Family Muscicapidae

VEERY

The nesting density of the Veery has increased on the study area since 1930-31. I found the Veery regularly in mature forest with little tendency to favor one type. Dilger (1956) said this species favored lush undergrowth, a condition lacking in the study area in 1983-85. Bertin (1977) suggested the amount of moisture in mature woodland was more important than undergrowth, as the Veery favored cool microclimates. It is likely that the younger forests of 1930-31 were drier because of less shade provided by the smaller trees. I believe the Veery increase is a consequence of the forest maturity in 1983-85.

Beardslee and Mitchell (1965) labeled the Veery the most common summer resident thrush in western New York. There has been no significant change in the Veery's local or regional status (Andrle and Carroll, 1988; Klabunde, 1986; Klingensmith and Hoover, 1985; Robbins *et al.*, 1986).

SWAINSON'S THRUSH

The Swainson's Thrush showed a nesting density decline. This thrush used a rather narrow nesting habitat at higher elevations where

the hemlocks are near their highest elevation (pers. obs.). Eaton (1981) said the Swainson's Thrush showed a partiality for nesting in hemlocks of small to moderate size. Saunders (1942) believed this species preferred hemlock and that it occurred most commonly along the spring line where hemlock was common. He said that empty nests believed to be Swainson's Thrush nests were not more than 10 feet (3m) above ground. The large size of the hemlocks in 1983-85, with lower branches pruned by deer, may limit nest sites for the Swainson's Thrush, although Eaton (1981) reported this species as nesting at heights from 3 to 9 m, which would be above the reach of deer.

Dilger (1956) and Holmes and Robinson (1988) reported that the Swainson's Thrush generally forages in the trees and is the most arboreal of the thrushes. Dilger (1956) felt the Swainson's Thrush was a competitor with the Scarlet Tanager, a species that showed a density decline similar to the Swainson's Thrush in the Quaker Run valley in 1983-85.

I find no obvious explanation for the nesting density decline of the Swainson's Thrush, but the significant increase reported by Robbins *et al.* (1986) for the eastern United States suggests that it may be local.

WOOD THRUSH

The Wood Thrush showed density declines in mature forest since 1930-31, but its increase in the maple-beech-cherry habitat led to a nesting density increase within all forested habitat of the study area. Saunders (1936) found this species less numerous than the Hermit Thrush except in mature forest. My observations indicate the Wood Thrush included, in its nesting habitat, areas of sprout American beech of moderate height (2-3m) which, shunned by deer (James Rich, pers. comm.), occurred in isolated patches of the maple-beech forest. Holmes and Robinson (1988) reported the Wood Thrush as a ground-foraging species. This thrush's foraging activities may have benefited from the openness of the Quaker Run forests in 1983-85.

Robbins *et al.* (1986) reported a significant increase of the Wood Thrush on the Allegheny Plateau. Weaver (*in* Bent, 1949) discussed the northward expansion of its breeding range. It is widely distributed as a nesting species in New York State (Andrle and Carroll, 1988).

Family Vireonidae

SOLITARY VIREO

The nesting density for the Solitary Vireo increased overall in the forest, but it declined in density in mature maple-beech-birch-hemlock forest. In 1983-85 the Solitary Vireo's highest density was in hemlock habitat, although it was present in other habitats. Saunders' (1936) data showed a similar distribution with the Solitary Vireo favoring hemlock forest but represented in other types. Saunders (1938) said this vireo did not occur when undergrowth was removed, and he speculated that this was because of a loss of nesting sites. This may be a factor in its density decline in the mature maple-beech-birch-hemlock habitat.

Breeding bird surveys showed the Solitary Vireo increased significantly on the Allegheny Plateau (Robbins *et al.*, 1986). Levine (*in* Andrle and Carroll, 1988) reported range extensions of the Solitary Vireo in New York State.

RED-EYED VIREO

The Red-eyed Vireo population showed an increase in absolute size but slight nesting density declines when mature forests were compared. The population increase occurred within the maple-beech-cherry habitat that was maple-beech-sprout forest in 1930-31. Thus, the overall population increase is probably a result of increased forest volume within this habitat.

This vireo sang frequently throughout the period of data collection in 1983-85. This behavior, also noted by Saunders (1938), reduced the chances of missing the Red-eyed Vireo during the censusing.

Robbins *et al.* (1986) described this species as the most common bird in the eastern deciduous forest, with average increases of 2 percent per year. Klabunde (1986) noted a possible decline through 19 years of breeding bird surveys in western New York State.

Family Emberizidae

YELLOW WARBLER

Saunders (1936) found the Yellow Warbler concentrated in the willow thicket habitat where its nesting density was 61.5 pairs per 100 acres (40 ha). Saunders felt the willow thicket supported such high numbers because it was strung out along streams near open areas, and he doubted it would support so many birds if it was in a different arrangement. I found the low and dense vegetation in the thicket and willow thicket-beaver meadow habitats supported a larger population of Yellow Warblers than in 1930-31 but in much lower densities. It is doubtful that this represents any real change in status of the Yellow Warbler.

Breeding bird surveys showed increases for Yellow Warblers locally and in the eastern United States (Robbins *et al.*, 1986; Klabunde, 1986; Klingensmith and Hoover, 1986).

MAGNOLIA WARBLER

The Magnolia Warbler showed an 83 percent nesting density decline in mature maple-beech-birch-hemlock where it was the most common breeding bird in 1930-31. This warbler nests in the zone below 2 metres (Harrison, 1975) and it seems likely that this large decline is related to the poorly developed understory, particularly the scarcity of young conifers. Hall (1984a, 1984b) found declines in Magnolia Warblers in West Virginia in areas where succession was an apparent explanation, but also recorded declines where there was no apparent change in the local habitat. Such observations illustrate the complexities of bird population changes. While the reduced forest understory in the study area is an attractive explanation for the declines in the low-nesting birds, it may only be a partial factor in their decline. Further study of the Magnolia Warbler and its nest placement in Allegany State Park would give a clearer picture of this species' decline.

Breeding bird surveys showed increases in Magnolia Warblers (Klabunde, 1986; Klingensmith and Hoover, 1986) particularly in the

northeastern United States (Robbins *et al.*, 1986). Eaton (*in* Andrle and Carroll, 1988) said the Magnolia Warbler showed little change in distribution since Eaton's (1910) map, but noted an apparent decline in some small populations near the Finger Lakes of New York State.

BLACK-THROATED BLUE WARBLER

Like the Magnolia Warbler, the large decline in the Black-throated Blue Warbler is undoubtedly related to the understory changes since 1930-31. This species is less dependent on hemlock than the Magnolia Warbler (Saunders, 1938), and it has declined because of the loss of broad-leaved saplings and shrubs, where its nests are generally found in this region (Eaton, 1981).

Eaton (1914) and Saunders (1938) stated that the abundance of the Black-throated Blue Warbler changed from year to year. Klabunde (1986) reported the Black-throated Blue Warbler as declining in western New York during 1967-1986.

BLACK-THROATED GREEN WARBLER

The Black-throated Green Warbler was the most abundant breeding bird in the Quaker Run valley in 1930-31. The population of this warbler in 1983-85 indicated a 64 percent nesting density decline over all forest habitat and a 74 percent decline in the mature maple-beech-birch-hemlock forest. The magnitude of the latter decline resembles that of the Magnolia Warbler, but the decline of the Black-throated Green Warbler is less readily explained. The Black-throated Green Warbler generally does not nest close to the ground (Harrison, 1975), thus it is less likely than the Magnolia Warbler to be affected by the lack of understory. The Magnolia Warbler, Black-throated Green Warbler and Blackburnian Warbler are species Saunders (1942) called the hemlock warblers. All three species have density declines since 1930-31, with the Magnolia Warbler having the largest decline and the Blackburnian Warbler the smallest in the mature maple-beech-birch-hemlock forest. If caused by conditions on the study area, their declines are probably related to the structure of the hemlocks in the forest in 1983-85. Some inter-specific interactions among these three species may influence their nesting in hemlock forest. Morse (1968) showed that Magnolia Warbler and Black-throated Green Warbler males broadly overlapped in the heights at which they foraged and sang in mature spruce forest in Maine.

Holmes *et al.* (1986) found in mature forest in New Hampshire that the Black-throated Green Warbler was stable over a 16-year period when 70 percent of the species breeding on a 10 hectare plot declined. Wilcove (1983) found spectacular increases in the Black-throated Green Warbler when he compared bird populations in undisturbed forest in Tennessee and North Carolina between 1982 and 1947-48. Robbins *et al.* (1986) documented an increase in the northeastern states that was negated by a decline in the southeastern states. Klabunde (1986) reported a possible decline for western New York.

BLACKBURNIAN WARBLER

Nesting density for the canopy-nesting Blackburnian Warbler has declined within the mature maple-beech-birch-hemlock forest since 1930-31. When all forested acreage is considered, the Blackburnian Warbler showed an increased nesting density. The overall density increase for this warbler is attributed to the maturation of the forest, in particular the oak-hickory. The Blackburnian Warbler showed the smallest decline of the three species Saunders (1942) called the "hemlock warblers" (see Black-throated Green Warbler account).

Saunders (1936, 1942) said the nesting of the Blackburnian Warbler in this region was colonial. Harrison (1975) noted the tendency of this warbler to nest in loosely scattered colonies, as did Knight (*in* Bent, 1953). Saunders (1936) said he tempered his final counts of the Blackburnian Warbler based upon his knowledge of its colonial nesting, but he did not elaborate.

Summaries of area breeding bird surveys (Klabunde, 1986 and Klingensmith and Hoover, 1986) indicate that this species may be declining in western New York State. Holmes *et al.* (1986) noted a gradual decline for the Blackburnian Warbler over a 16-year period in New Hampshire. They felt the decline may have represented population declines in more central parts of its range because of the marginal nature of the habitat for Blackburnian Warblers at their study site. Wilcove (1983) found a sizeable decline in Blackburnian Warblers in comparing populations in 1982 and 1947-48 in North Carolina and Tennessee. Robbins *et al.* (1986) showed an increase in northeastern states that was not enough to produce an increase for the entire eastern region. Levine (*in* Andrle and Carroll, 1988) felt the greatest threat to the Blackburnian Warbler was not on its breeding ground but on its wintering ground where forests were being rapidly destroyed.

CERULEAN WARBLER

The Cerulean Warbler was a common species of the mature oak-hickory-forest in 1983-85. Saunders (1942) observed a Cerulean Warbler in 1921 in the Quaker Run valley, but was unable to confirm its presence in subsequent years. Stephen W. Eaton noted (pers. comm.) that the Cerulean Warbler was displaced from the Allegheny River bottomlands by the formation of the Allegheny Reservoir, which may have stimulated the Cerulean Warbler increase in the higher oak woodlands adjacent to the Allegheny River valley.

The range of the Cerulean Warbler has expanded into western New York since Saunders' era (Bull 1974; Andrle and Carroll 1988).

BLACK-AND-WHITE WARBLER

The Black-and-white Warbler was rare as a breeding bird in the study area in 1983-85. This warbler is most commonly found in oak forests in this region (Eaton, 1981). Saunders (1936) determined the Black-and-white Warbler's highest nesting density at 8.6 pairs per 100 acres (40 ha) in mature oak-hickory; he reported lower densities in other forested habitats and found it missing from the sprout maple-beech forest.

The Black-and-white Warbler has finished nesting by the dates included in this study. Bent (1953) noted a tendency of the Black-and-white Warbler to stray away from nesting areas early. If the 1983-85 censuses missed this species because it had already left following nesting, Saunders should have encountered a similar phenomenon, but

he apparently did not. Saunders (1938) reported the average date of song cessation for the Black-and-white Warbler as 26 July, well after the study period. Saunders (1942) noted the first migratory movements occurred in late July and early August.

Kendeigh (1945) said the Black-and-white Warbler was commonly found in the forest edge habitat rather than the forest interior when a good stand of trees developed. Possibly the loss of edge habitat through the general maturation of the forests in the study area has had an effect on the Black-and-white Warbler.

Although the Black-and-white Warbler is a ground-nesting species, it is not immediately apparent that a lack of understory should affect its nesting. The placement of its nest, described by Harrison (1975) and Bent (1953), does not depend upon herbaceous plants of the forest floor for concealment. This species does not use the understory for foraging (Bent, 1953).

The Black-and-white Warbler was rarely recorded on breeding bird surveys in western New York State (Klabunde, 1986), but little oak forest was included in the surveys. Eaton (1981) felt the Black-and-white Warbler became less common in Cattaraugus County in the 1970s because of selective cutting of oaks, but no cutting occurred in the oak forests of the study area. Eaton (*in* Andrle and Carroll, 1988) reported little change in distribution of this species over the last century in New York State.

AMERICAN REDSTART

The nesting density of the American Redstart may have declined slightly in mature maple-beech-birch-hemlock forest, but its density for all forest has increased since 1930-31. Eaton (1981) said it nests commonly in oak forest where there are openings below the canopy for aerial capture of insects and less commonly in birch-beech-maple-hemlock forest. The nesting density of the American Redstart has increased greatly in mature oak-hickory since 1930-31 (Table 2). Saunders (1942) said this warbler preferred areas with undergrowth and the young dense forest. Sherry (1979) noted the broad habitat requirements of the American Redstart. Hickey (1940) noted the wandering of unmated singing male American Redstarts during the nesting season. Such birds, when counted, would inflate the density figures, but probably equally for both studies being discussed in this paper.

Breeding bird surveys (Robbins *et al.*, 1986) indicated an increase of redstarts in the eastern United States, especially in New York State. Klabunde (1986) reported the American Redstart as possibly increasing in western New York State, while Klingensmith and Hoover (1986) indicated a slight decline for Allegany County, New York.

OVENBIRD

Ovenbirds were fairly uniformly distributed in the forested habitats in 1983-85. Nevertheless, this species showed a marked nesting density decline of 68 percent in forested habitat since 1930-31. This large decline is puzzling. Harrison (1975) said that the Ovenbird favors areas with low undergrowth, which the study area generally lacked in 1983-85. The observations of Saunders (1936) and Bent (1953) indicated that the Ovenbird was not dependent upon dense undergrowth within its nesting habitat. Holmes *et al.* (1986) noted abrupt changes in Ovenbird densities over a 16-year period in New Hampshire. The yearly data on the Ovenbird for 1983-85 showed no abrupt changes and Saunders (1938) noted little change in abundance from year to year.

Breeding bird surveys showed the Ovenbird increasing locally and throughout the eastern portion of North America (Klabunde, 1986; Klingensmith and Hoover, 1986; Robbins *et al.*, 1986). Wilcove (1983) found that the Ovenbird had declined slightly in undisturbed forest between 1947-48 and 1982 in Tennessee and North Carolina.

LOUISIANA WATERTHRUSH

The Louisiana Waterthrush has been added to the breeding birds of the Quaker Run valley since 1930-31. Saunders (1942) said the Louisiana Waterthrush was seen nearly every year as a migrant in late July. This warbler had finished nesting by the study dates, and the 1983-85 count is likely lower than actual because few Louisiana Waterthrushes were still singing. Eaton (1981) gave 15 April as the Louisiana Waterthrush average return date for Cattaraugus County, which is much earlier than the other warblers. Eaton (1981) said this species has apparently increased since Saunders' time as forest cover increased and streamside habitat had improved following the disruptions of the logging industry.

MOURNING WARBLER

Saunders (1942) said the Mourning Warbler was not a forest bird, and its occurrence in 1930-31 was restricted to sprout or temporary forests. In 1983-85, the Mourning Warbler occurred in the mature forests where low growth, particularly blackberry or raspberry (*Rubus* spp.) occurred in openings around fallen trees or along old logging roads (pers. obs.; also see Eaton, 1981).

Saunders' (1936) nesting densities of the Mourning Warbler were higher for the young forests of 1930-31 than for the mature forests in 1983-85. The rather special nesting habitat selected by the Mourning Warbler was generally more available in 1930-31. This species had a scattered distribution in the forests of 1983-85 and this may have distorted my estimate of 126 pairs for the Quaker Run valley. Smith (*in* Andrle and Carroll, 1988) noted that the Mourning Warbler was especially vulnerable to raccoon predation. The high population of raccoons in Allegany State Park may be affecting the local population of this warbler.

COMMON YELLOWTHROAT

This species was common (13.6 pairs per 100 acres) in the young aspen cherry forest of 1930-31. The loss of that habitat through the maturation of forests in the study area has decreased the size of available habitat for the Common Yellowthroat. This warbler was common in the thicket and willow thicket-beaver meadow habitats in 1983-85. The Common Yellowthroat densities in 1983-85 were comparable to those reported by Saunders (1936).

HOODED WARBLER

The Hooded Warbler showed an overall nesting density increase since 1930-31 in forested habitat, but like all species common to 1930-31 and 1983-85, it showed a density decline in mature maple-beech-birch-hemlock forest. Saunders (1936) found this warbler only in mature forest; its population has likely benefited from the expansion that has occurred in mature forest since that time.

Learning how the understory changes have affected nest sites of the low-nesting Hooded Warbler might give some insight into why other species nesting in the understory have shown much larger population declines. My observations agree with those of Williams (*in* Bent, 1953) that the Hooded Warbler uses isolated patches of low growth for nesting. Thick patches of sprout beech and striped maple (*Acer pensylvanicum*) occurred in 1983-85 in scattered areas; the striped maple generally grew on slopes where deer do not usually occur in winter (James Rich, pers. comm.). It may be that the Black-throated Blue Warbler, which showed a very large density decline, cannot adjust to this fragmented understory.

Bent (1953) described the Hooded Warbler as a good flycatcher and said that it also foraged on or near the ground. This foraging behavior may enable this species to obtain food in spite of the poor development of low foliage from which insects could be gleaned.

Todd (1940) suspected that the Hooded Warbler was expanding northward in western Pennsylvania, an expansion which likely extended into southwestern New York. Wilcove (1983) found a sizeable decline in the Hooded Warbler in forests of Tennessee and North Carolina between 1947-48 and 1982.

CANADA WARBLER

The Canada Warbler was rare in the study area in 1983-85, whereas Saunders (1942) called it a common breeding bird and reported finding nests in July. Saunders (1936) did not find the Canada Warbler nesting in mature forest. The loss of young forest seres coupled with a poorly developed understory likely accounts for the reduction in the Canada Warbler population. According to Eaton (1981) this warbler is found in forests with a shrubby understory.

Klabunde (1986) and Klingensmith and Hoover (1986) reported declines in the Canada Warbler on breeding bird surveys in western New York. In a comparison of bird populations in undisturbed forest of the Great Smokey Mountains of Tennessee and North Carolina, Wilcove (1983) reported a sizeable decline for the Canada Warbler.

SCARLET TANAGER

The Scarlet Tanager showed a 40 percent nesting density decline between 1930-31 and 1983-85. My observations suggest that the Scarlet Tanager was more numerous than indicated by the census of singing males. It may be that my estimates were distorted by birds missed because they were not singing. Saunders (1942) said that this species sang through July, but made no reference to the prevalence of song. I do not know what effects, if any, local changes in the Quaker Run valley have had on the Scarlet Tanager. Saunders (1942) reported the Scarlet Tanager as somewhat more numerous in mature forest than young forest.

Holmes *et al.* (1986) reported that large-scale mortality in late May of 1974 reduced the population of the Scarlet Tanager at Hubbard Brook, New Hampshire, for several years. Robbins *et al.* (1986) revealed an overall increase in the Scarlet Tanager in the eastern United States. Wilcove (1983) found no changes in the Scarlet Tanager in the mountains of Tennessee and North Carolina between 1947-48 and 1982. Klabunde (1986) indicated no noteworthy changes on western New York State breeding bird surveys.

ROSE-BREASTED GROSBEAK

The Rose-breasted Grosbeak showed a nesting density decline of 39 percent in forested habitat. This number is nearly identical to the decline calculated for the Scarlet Tanager, and, like that species, the Rose-breasted Grosbeak was not vocally conspicuous in 1983-85. Rose-breasted Grosbeaks and Scarlet Tanagers showed similar population trends on the 10 hectare plot studied by Holmes *et al.* (1986) in New Hampshire. Unlike the Scarlet Tanager, the Rose-breasted Grosbeak has lost prime nesting habitat as the forests have grown and the understory has declined in the Quaker Run valley. Bonney (*in* Andrle and Carroll, 1988) said the Rose-breasted Grosbeak thrived in disturbed habitats and was generally found in areas of dense undergrowth.

Breeding bird surveys in western New York (Klabunde, 1986) and eastern United States (Robbins *et al.*, 1986) showed an increase for the Rose-breasted Grosbeak.

INDIGO BUNTING

The Indigo Bunting has declined in total population and nesting density, although the habitats where the Indigo Bunting had the highest densities in 1930-31 — oak-hickory sprout forest and thicket — have changed and do not compare closely to habitats in 1983-85.

Significant increases were recorded for the Great Lake states and northeastern states on breeding bird surveys (Robbins *et al.*, 1986). Arbib (*in* Andrle and Carroll, 1988) called the Indigo Bunting a widespread and common breeding bird in New York State.

Species Not Migrating to the Neotropics

Species discussed under this heading are migrants to areas north of the neotropics or species that reside the year around on the study area. Changes in populations of these species do not relate to conditions in the neotropics. Permanent resident population changes help to define the effects local habitat changes have had on breeding birds in the Quaker Run valley.

Family Phasianidae

RUFFED GROUSE

A decline in the Ruffed Grouse was indicated since 1930-31. This species was not censused using transect counts. Encounters with Ruffed

Grouse were chance occurrences that lead to rough estimates of the population. Saunders (1936) mentioned the difficulty of censusing this species and considered his estimate a conservative guess.

Bump *et al.* (1947) detailed the habitat requirements of the Ruffed Grouse. Their investigations found that the Ruffed Grouse prospers in sub-climax forest with considerable undergrowth and a more or less open crown. They reported that extensive unbroken forests seldom support abundant Ruffed Grouse populations. Eaton (1981) said Cattaraugus County had high populations of Ruffed Grouse in the 1950s which had declined in the 1960s and 1970s because of changes in land use and maturation of the forests.

It is likely the Ruffed Grouse populations were lower in the Quaker Run valley in 1983-85 than they were in 1930-31 because of less favorable habitat resulting from forest succession and loss of undergrowth.

Family Picidae

Five species of woodpecker bred in the Quaker Run valley in 1983-85: Yellow-bellied Sapsucker, Downy Woodpecker, Hairy Woodpecker, Northern Flicker, and Pileated Woodpecker. These species are considered together here.

Woodpecker counts in 1983-85 depended heavily on visual observation. Only the Yellow-bellied Sapsucker drummed regularly during the study period. Downy and Hairy Woodpeckers were usually observed as adults in the company of fledged young. Northern Flickers were observed as single birds. I observed the Pileated Woodpecker once in three years of censusing, but my observations at other times indicated that the Pileated Woodpecker occurred regularly. Saunders (1936) listed the Pileated Woodpecker as irregular in the mature maple-beech-hemlock forest of the Quaker Run valley.

The Yellow-bellied Sapsucker was not recorded as a breeding bird on the study area in 1930-31. Saunders (1942) called it regular, but uncommon, in Allegany State Park and said he did not encounter it in the Quaker Run valley until 1938. The data collected in 1983-85 indicated the Yellow-bellied Sapsucker was the most common woodpecker in the Quaker Run valley. Levine (*in* Andrle and Carroll, 1988) reported a range expansion of the Yellow-bellied Sapsucker in New York State and noted a strong presence along the Appalachian Plateau. Breeding bird surveys showed a significant decline for the Yellow-bellied Sapsucker in the northeastern states and Canada which was attributed to the severe winter of 1976-77 (Robbins *et al.*, 1986).

The Downy Woodpecker did not inhabit any of the truly forested habitats in 1930-31. The temporary aspen-cherry habitat contained most of the Downy Woodpecker population at that time. The nesting density of the Downy Woodpecker showed a decline in 1983-85, but like many species in this report, it has increased its overall population by extending its range within the study area.

The Hairy Woodpecker also declined in nesting density since 1930-31, but unlike the Downy Woodpecker, indications are that it also declined in total population. Saunders (1938) said that the Hairy Woodpeckers were at a height of abundance in 1930 when he estimated the population in the Quaker Run valley. He subsequently reduced his figures to conform to the average year. As noted earlier, this species had finished nesting by the time of the census and my estimate is based upon chance encounters. If the Hairy Woodpecker decline is real, a possible factor is the establishment of the Yellow-bellied Sapsucker as a competitor for nest sites or other resources. However, Lawrence (1967) observed that these two species tolerated nesting near each other in central Ontario. Klingensmith and Hoover (1986) reported a decline in Hairy Woodpeckers during 15 years of surveys in Allegany County, New York, but the data involved small numbers. Yunick (1988) analyzed data from Christmas Counts covering 26 years in New York State and found declines in both the Downy and Hairy Woodpeckers. Excluding Long Island, the Hairy Woodpecker declined about 55-61 percent, which was approximately twice the decline for the Downy Woodpecker.

The Northern Flicker also declined in density since 1930-31. Bent (1939) described the habitat of the Northern Flicker as open country and lightly wooded regions. The mature forest in the Quaker Run study area contained few openings in 1983-85 and this likely reduced its attractiveness to flickers. Robbins *et al.* (1986) attributed highly significant declines for the Northern Flicker to competition for nest sites with the European Starling. Competition for nest sites was possible in the open areas of the Quaker Run valley, but the European Starling did not enter the forested habitats. Sibley (*in* Andrle and Carroll, 1988) said the Northern Flicker was a widespread breeder in New York State, being most abundant in woodland and wood edges where there are open areas for foraging.

Family Corvidae

BLUE JAY

Blue Jays were observed infrequently during the censuses in 1983-85. This species was not vocal during the census period. When seen, the Blue Jays were in small groups, which presumably were adults with young of the year. Their retiring nature at the time of the censuses suggested that my estimate of the nesting density of Blue Jays might be low; yet the Blue Jay had undoubtedly declined in nesting density since 1930-31. I attribute this decline to the development of extensive mature forest and the loss of agriculture in the Quaker Run valley. Over 85 percent of the population of Blue Jays in 1930-31 was in young maple-beech-hemlock forest and maple-beech sprout forest.

Robbins *et al.* (1986) said the Blue Jay showed significant increases on the Allegheny Plateau. Klabunde (1986) reported the Blue Jay as increasing in western New York breeding bird surveys, while Klingensmith and Hoover (1986) reported a slight decline in Allegany County, New York.

AMERICAN CROW

A large nesting density decline is indicated for the American Crow since 1930-31. I believe the American Crow, like the Blue Jay, has declined as a consequence of the development of extensive, mature forest on the study area.

Bonney (*in* Andrle and Carroll, 1986) said the American Crow may decline as much of New York reverts to forested land, and he noted the increase of the Common Raven in New York State. The Common Raven has invaded Allegany State Park and may be nesting within the Park (pers. obs.).

Families Paridae and Sittidae

BLACK-CAPPED CHICKADEE AND WHITE-BREASTED NUTHATCH

Nesting density changes have occurred for both the Black-capped Chickadee and White-breasted Nuthatch. My estimates may be low because, like the other permanent resident birds that nest early in the Quaker Run valley, they are based on chance encounters with wandering family groups.

A comparison of the total nesting density data from all forested habitats in 1930-31 and 1983-85 showed a 68 percent decline for the Black-capped Chickadee and a fivefold increase for the White-breasted Nuthatch. When only mature forest is compared, the Black-capped Chickadee showed an increase in maple-beech-birch-hemlock. These data suggest to me that the Black-capped Chickadee has spread into the extensive mature forest at much lower densities than in 1930-31. The White-breasted Nuthatch has also spread over a larger area since 1930-31, but it has shown only a small density decline in mature forest. Saunders (1942) said that the Black-capped Chickadee was uncommon in mature maple-beech forests and called the White-breasted Nuthatch common in older forests.

Robbins *et al.* (1986) reported significant increases for the Black-capped Chickadee on the Allegheny Plateau and significant decline for the White-breasted Nuthatch in New York. Klabunde (1986) found the Black-capped Chickadee to be increasing on western New York surveys, and Klingensmith and Hoover (1986) showed the White-breasted Nuthatch declining in Allegany County, New York.

Family Troglodytidae

WINTER WREN

The total population of the Winter Wren in the Quaker Run valley showed an increase in 1983-85, in spite of a small nesting density decline in the maple-beech forest. Eaton (1981) said that the Winter Wren appeared to be increasing with the recovery of forest in Cattaraugus County and that records showed a considerable range of expansion since the 1930s.

While the Winter Wren nests low, the loss of understory presumably had little impact on its nesting because this species places nests in hollows and cavities (pers. obs.; Harrison, 1975). The Winter Wren was more abundant on the study area in 1983-85 than in 1930-31 but its range was restricted to the higher elevations.

Winter Wren populations in the eastern United States were increasing until the severe winters of 1976-77 and 1977-78 caused a great decline (Robbins *et al.* 1986).

Family Muscicapidae

HERMIT THRUSH

The Hermit Thrush showed a 48 percent nesting density decline in forested habitat since 1930-31. This species showed a similar decline in total population. Saunders (1936) did not record the Hermit Thrush in mature maple-beech-hemlock forest and found its population almost exclusively in young maple-beech-hemlock and temporary aspen-cherry. Saunders (1938, 1942) stated the Hermit Thrush was the most common thrush in Allegany State Park, but it did not occur in mature forest or in areas cleared of undergrowth. In 1983-85, the Hermit Thrush was usually observed just below the ridge tops in the maple-beech-cherry habitat at higher elevations. These are areas of windfalls that open the forest canopy. Deer forage on these slopes less frequently in the winter than the more gentle slopes of lower elevation (James Rich, pers. comm.). The openings, coupled with less deer pressure, provided areas of denser undergrowth than in most of the forests of the study area.

Dilger (1956) described prime Hermit Thrush habitat as dense, young coniferous-deciduous forest. Such habitat was much more common in 1930-31 than 1983-85. The change in habitat is undoubtedly a factor in the decline of the Hermit Thrush. On the other hand, S. W. Eaton (pers. comm.) said the Hermit Thrush favors openness in the forest, an association Holmes and Robinson (1988) also reported for a study plot in northern hardwoods forest in New Hampshire.

Family Emberizidae

DARK-EYED JUNCO

In the forests of the Quaker Run valley, the Dark-eyed Junco and Hermit Thrush were the only ground-nesting species that do not migrate to the neotropics. My estimates indicate the Dark-eyed Junco had a modest population decline of 15 percent and a nesting density decline of 18 percent in forest overall. Saunders' (1936) highest nesting density for the Dark-eyed Junco was in the mature maple-beech-hemlock forest where the 1983-85 estimate indicated a large density decline.

In general the Dark-eyed Junco declines are not as large as those suffered by species migrating to the neotropics. The explanation, however, may not be related to migration. The Dark-eyed Junco nests in sheltered ground sites, often in the upturned roots of windfalls (pers. obs.). This behavior would reduce the negative effects of predation resulting from a loss of cover vegetation.

Robbins *et al.* (1986) showed a significant decrease in the Dark-eyed Junco for New York State during the period 1965-79. Eaton (*in* Andrle and Carroll, 1988) felt the recovery of forest was responsible for a general distribution of the Dark-eyed Junco on the Appalachian Plateau of New York State. Klabunde (1986) reported the Dark-eyed Junco to be increasing on breeding bird surveys in western New York.

Summary and Conclusions

Aretas A. Saunders censused bird populations in the Quaker Run Valley of Allegany State Park from 1 through 15 July in 1930 and 1931. The results of his study were published as a New York State Museum Handbook entitled: *Ecology of the Birds of Quaker Run Valley, Allegany State Park, New York* (Saunders, 1936). After World War II, the ecological studies of Saunders and others at the Allegany School of Natural History were not formally continued. Using Saunders' methods, I attempted to repeat his Quaker Run study from 1 through 15 July in 1983, 1984, and 1985.

I compared the estimated breeding bird populations from each study to indicate the changes that have occurred after more than 50 years. I also analyzed changes in the habitats of the Quaker Run valley over the 50-year period to help determine what factors have influenced the breeding bird population changes. Emphasis in this study is on the changes in breeding birds within the forests of the study area.

Forested habitats covered about 90 percent of the Quaker Run valley in 1930-31 and 1983-85. The data suggest a 14.5 percent decline in overall nesting density for forest species since 1930-31. The population and nesting density changes in forest birds are discussed in light of significant changes that have occurred through the maturation of extensive forest, the cessation of farming, and the effects of white-tailed deer foraging the understory and ground vegetation. These local habitat changes affect the bird populations in a variety of ways and are the most obvious explanation for the breeding bird changes in the Quaker Run valley. However, as Holmes *et al.* (1986) pointed out, diverse factors (e.g. vegetation structure, food abundance, interspecific competitors, weather effects, and effects on migrants at wintering grounds) influence bird populations in temperate deciduous forest. I have included published information on trends observed for several species beyond the study area.

This study offers little information to suggest that population declines in birds migrating from the study area to the neotropics may be related to habitat changes in the neotropics, but there is also no information to refute that possibility. I believe that the extensive, unfragmented, mature forest of the Quaker Run valley and Allegany State Park is a valuable resource to birds. The Park is a haven to birds in an era when human populations and economic growth alter the land and demand its resources on a global scale. As stated 50 years ago by Aretas A. Saunders (1936), "...the truth remains that if we destroy or change the natural areas in which a given form of wildlife lives and finds its food and reproduces, we destroy that form more certainly than if we started an intentional, organized attempt to eliminate it by other means."

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Appendix I

Populations of Breeding Birds in the Quaker Run Valley: 1930-31 and 1983-85

Field observations, outside the study dates, by myself and Dr. Richard Clark (pers. comm.) suggest that Killdeer, Chimney Swift, Eastern Bluebird, Brown Thrasher, and Purple Finch continue to nest in the Quaker Run valley, although possibly irregularly.

A comparison of the total number of nesting species in 1930-31 and 1983-85 shows that changes in species composition have taken place with little change in the total number of species - 90 species and 91 species, respectively.

A Comparison of the Estimated Total Breeding Pairs of the Quaker Run Valley: 1930-1931 and 1983-1985

	1930-1931	*1983-1985*
1. Red-eyed Vireo	1656	2558
2. American Redstart	389	1053
3. Black-throated Green Warbler	1670	721
4. Dark-eyed Junco	723	611
5. Blackburnian Warbler	160	554
6. Ovenbird	1196	443
7. Least Flycatcher	60	425
8. Wood Thrush	280	419
9. Veery	26	402
10. Hooded Warbler	23	367
11. American Robin	723	361
12. Magnolia Warbler	868	350
13. Chipping Sparrow	138	295
14. White-breasted Nuthatch	35	284
15. Yellow-bellied Sapsucker	0	282
16. Scarlet Tanager	367	254
17. Black-capped Chickadee	675	230
18. Rose-breasted Grosbeak	288	183
19. Brown Creeper	Irregular	179
20. Eastern Wood-Pewee	46	173
21. Hermit Thrush	324	166
22. Song Sparrow	477	164
23. Solitary Vireo	158	149
24. Hairy Woodpecker	270	141
25. Mourning Warbler	46	126
26. Common Yellowthroat	188	112

	1930-1931	1983-1985
27. Cerulean Warbler	0	87
28. Downy Woodpecker	33	68
29. Gray Catbird	57	68
30. Swainson's Thrush	181	65
31. Winter Wren	32	58
32. Field Sparrow	111	55
33. Acadian Flycatcher	0	54
34. Indigo Bunting	179	54
35. Rufous-sided Towhee	311	54
36. Northern Flicker	90	41
37. Black-throated Blue Warbler	506	41
38. Yellow Warbler	24	34
39. Ruffed Grouse	50	23
40. Chestnut-sided Warbler	161	22
41. American Goldfinch	109	21
42. Black-billed Cuckoo	7	18
43. Cedar Waxwing	310	18
44. Blue Jay	220	17
45. Red-winged Blackbird	34	17
46. Yellow-throated Vireo	Irregular	13
47. Ruby-throated Hummingbird	22	12
48. Willow Flycatcher	Irregular	12
49. Barn Swallow	32	12
50. Brown-headed Cowbird	10	11
51. Common Grackle	3	10
52. Cliff Swallow	43	8
53. Eastern Kingbird	10	7
54. Blue-gray Gnatcatcher	0	7
55. Louisiana Waterthrush	0	7
56. Canada Warbler	282	7
57. Savannah Sparrow	56	6
58. American Woodcock	28	5
59. Barred Owl	10	5
60. European Starling	14	5
61. Blue-winged Warbler	0	5
62. Nashville Warbler	Irregular	5
63. Eastern Phoebe	30	4
64. Great Crested Flycatcher	Irregular	4
65. American Crow	152	4
66. Black-and-white Warbler	91	4
67. Red-tailed Hawk	6	3
68. House Wren	43	3
69. Eastern Meadowlark	28	3
70. Northern Oriole	4	3
71. Green-backed Heron	0	2
72. Sharp-shinned Hawk	3	2
73. Red-shouldered Hawk	4	2
74. Wild Turkey	0	2
75. Yellow-billed Cuckoo	3	2
76. Belted Kingfisher	4	2
77. Pileated Woodpecker	Irregular	2

	1930-1931	*1983-1985*
78. Tree Swallow	0	2
79. Bobolink	3	2
80. Swamp Sparrow	Irregular	2
81. Wood Duck	0	1
82. Mallard	0	1
83. Cooper's Hawk	1	1
84. Northern Goshawk	0	1
85. Broad-winged Hawk	0	1
86. Spotted Sandpiper	6	1
87. Northern Saw-whet Owl	0	1
88. Northern Rough-winged Swallow	2	1
89. Northern Parula	Irregular	1
90. Northern Cardinal	0	1
91. Yellow-throated Warbler	0	1
92. Chimney Swift	88	0
93. Vesper Sparrow	79	0
94. House Sparrow	17	0
95. Brown Thrasher	15	0
96. Eastern Bluebird	12	0
97. Mourning Dove	10	0
98. Whip-poor-will	10	0
99. Eastern Screech-Owl	8	0
100. Purple Finch	8	0
101. Long-eared Owl	5	0
102. Killdeer	4	0
103. American Kestrel	1	0
104. Northern Waterthrush	Irregular	0
105. Yellow-breasted Chat	Irregular	0
106. Grasshopper Sparrow	Irregular	0
Total Pairs	14,353	12,013
Total Density	(84.6/100A)	73.1/100A)

Appendix II

Scientific Names of the Birds

This list contains the binomials for all species of birds mentioned in the paper. The binomials conform to the American Ornithologists' Union check-list (1983).

1. *Ardea herodias* **
   Great Blue Heron
2. *Butorides striatus* **
   Green-backed Heron
3. *Aix sponsa* **
   Wood Duck
4. *Anas platyrhynchos* **
   Mallard
5. *Mergus merganser*
   Common Merganser
6. *Accipiter striatus* **+
   Sharp-shinned Hawk
7. *Accipiter cooperii* **+
   Cooper's Hawk
8. *Accipiter gentilis* +
   Northern Goshawk
9. *Buteo lineatus* +
   Red-shouldered Hawk
10. *Buteo platypterus* *+
    Broad-winged Hawk
11. *Buteo jamaicensis* **+
    Red-tailed Hawk
12. *Falco sparverius* **+
    American Kestrel
13. *Bonasa umbellus* -
    Ruffed Grouse
14. *Meleagris gallopavo* -
    Wild Turkey
15. *Charadrius vociferus* **
    Killdeer
16. *Actitis macularia* **
    Spotted Sandpiper
17. *Scolopax minor* -
    American Woodcock
18. *Larus delawarensis* **
    Ring-billed Gull
19. *Zenaida macroura* **
    Mourning Dove
20. *Coccyzus erythropthalmus**-
    Black-billed Cuckoo
21. *Coccyzus americanus* *
    Yellow-billed Cuckoo
22. *Otus asio* +
    Eastern Screech-Owl
23. *Strix varia* +
    Barred Owl
24. *Asio otus* +
    Long-eared Owl

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25. *Aegolius acadicus* +
Northern Saw-whet Owl

26. *Caprimulgus vociferus* *
Whip-poor-will

27 *Chaetura pelagica* *+
Chimney Swift

28. *Archilochus colubris* *+
Ruby-throated Hummingbird

29. *Ceryle alcyon* **
Belted Kingfisher

30. *Sphyrapicus varius* **+
Yellow-bellied Sapsucker

31. *Picoides pubescens* +
Downy Woodpecker

32. *Picoides villosus* +
Hairy Woodpecker

33. *Colaptes auratus* +
Northern Flicker

34. *Dryocopus pileatus* +
Pileated Woodpecker

35. *Contopus virens* *+
Eastern Wood-Pewee

36. *Empidonax virescens* *+
Acadian Flycatcher

37. *Empidonax trailli* *
Willow Flycatcher

38. *Empidonax minimus* *+
Least Flycatcher

39. *Sayornis phoebe* **
Eastern Phoebe

40. *Myiarchus crinitis* *
Great Crested Flycatcher

41. *Tyrannus tyrannus* *
Eastern Kingbird

42. *Tachycineta bicolor* *
Tree Swallow

43. *Stelgidopteryx serripennis* *
Northern Rough-winged Swallow

44. *Hirundo pyrrhonota* *
Cliff Swallow

45. *Hirundo rustica* *
Barn Swallow

46. *Cyanocitta cristata* +
Blue Jay

47. *Corvus brachyrhynchos* +
American Crow

48. *Corvus corax*
Common Raven

49. *Parus atricapillus* +
Black-capped Chickadee

50. *Sitta canadensis*
Red-breasted Nuthatch

51. *Sitta carolinensis* +
White-breasted Nuthatch

52. *Certhia americana* +
Brown Creeper

53. *Troglodytes aedon* *
House Wren

54. *Troglodytes troglodytes* -
Winter Wren

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55. *Regulus satrapa*
Golden-crowned Kinglet

56. *Polioptila caerulea* *
Blue-gray Gnatcatcher

57. *Sialia sialis* **
Eastern Bluebird

58. *Catharus fuscescens* *-
Veery

59. *Catharus ustulatus* *-
Swainson's Thrush

60. *Catharus guttatus* **-
Hermit Thrush

61. *Hylocichla mustelina* *+
Wood Thrush

62. *Turdus migratorius* **+
American Robin

63. *Dumetella carolinensis* *
Gray Catbird

64. *Toxostoma rufum*
Brown Thrasher

65. *Bombycilla cedrorum* **+
Cedar Waxwing

66. *Sturnus vulgaris*
European Starling

67. *Vireo solitarius* *+
Solitary Vireo

68. *Vireo flavifrons* *+
Yellow-throated Vireo

69. *Vireo olivaceus* *+
Red-eyed Vireo

70. *Vermivora pinus* *
Blue-winged Warbler

71. *Vermivora chrysoptera* *
Golden-winged Warbler

72. *Vermivora chrysoptera* x *pinus* *
Brewster's Warbler

73. *Vermivora ruficapilla* *
Nashville Warbler

74. *Parula americana* *
Northern Parula

75. *Dendroica petechia* *
Yellow Warbler

76. *Dendroica pensylvania* *-
Chestnut-sided Warbler

77. *Dendroica magnolia* *-
Magnolia Warbler

78. *Dendroica caerulescens* *-
Black-throated Blue Warbler

79. *Dendroica coronata* **
Yellow-rumped Warbler

80. *Dendroica virens* *+
Black-throated Green Warbler

81. *Dendroica fusca* *+
Blackburnian Warbler

82. *Dendroica dominica* *+
Yellow-throated Warbler

83. *Dendroica cerulea* *+
Cerulean Warbler

84. *Mniotilta varia* *-
Black-and-white Warbler

85. *Setophaga ruticilla* *+
American Redstart

86. *Seiurus aurocapillus*-
Ovenbird

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87. *Seiurus noveboracensis* *-
Northern Waterthrush

88. *Seiurus motacilla* *-
Louisiana Waterthrush

89. *Oporornis philadelphia* *-
Mourning Warbler

90. *Geothlypis trichas* *
Common Yellowthroat

91. *Wilsonia citrina* *-
Hooded Warbler

92. *Wilsonia canadensis* *-
Canada Warbler

93. *Icteria virens* *
Yellow-breasted Chat

94. *Piranga olivacea* *+
Scarlet Tanager

95. *Cardinalis cardinalis*
Northern Cardinal

96. *Pheucticus ludovicianus* *+
Rose-breasted Grosbeak

97. *Passerina cyanea* *-
Indigo Bunting

98. *Pipilo erythrophthalmus* **
Rufous-sided Towhee

99. *Spizella passerina* **-
Chipping Sparrow

100. *Spizella pusilla* **
Field Sparrow

101. *Pooecetes gramineus* **
Vesper Sparrow

102. *Passerculus sandwichensis* **
Savannah Sparrow

103. *Ammodramus savannarum***
Grasshopper Sparrow

104. *Melospiza melodia* **
Song Sparrow

105. *Melospiza georgiana* **
Swamp Sparrow

106. *Junco hyemalis* -
Dark-eyed Junco

107. *Dolichonyx oryzivorus* *
Bobolink

108. *Agelaius phoeniceus* **
Red-winged Blackbird

109. *Sturnella magna* **
Eastern Meadowlark

110. *Quiscalus quiscula*
Common Grackle

111. *Molothrus ater* **+
Brown-headed Cowbird

112. *Icterus galbula* *
Northern Oriole

113. *Carpodacus purpureus*
Purple Finch

114. *Carduelis tristis* **
American Goldfinch

115. *Passer domesticus*
House Sparrow

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